IOSR Journal Of Pharmacy And Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 17, Issue 2 Ser. II (Mar. –Apr. 2022), PP 01-22
www.Iosrjournals.Org

Epidemiology of Malaria in an Urban and a Rural Area Of Benue State Of Nigeria

Joseph Otafu Adaji[1*]., Onogwu Jacob Idoko[2] and Benard O Atu[2]
[1]*Department of Biochemistry, Faculty of Life Sciences, Ahmadu Bello University, Zaria, Nigeria.*
[2]*Department of Biological Science, Benue State University, Makurdi, Nigeria.*
**Corresponding author: Joseph Otafu Adaji*

Abstract
Malaria remains a major cause of mortality among children under the age of five year; it is endemic throughout Nigeria with seasonal variation. The objective of this study was to determine and compare the current status of malaria in an urban and a rural area of Benue state. A total of 384 blood samples were collected by simple random sampling from respondents in Makurdi township (200) and Orokam district (184) using the finger prick method and observed for the presence of malaria parasite using rapid diagnostic test kits and questionnaires to collect other information. Out of the 384 screened during the period of the study, 31.7% were positive malaria parasite. High prevalence of 41.2% was recorded in children 1-5 years. Infection was slightly higher in males (36.6%) than females with 27.9% (P>0.05). the study identified inaccessibility (20.8%) and inconvenience (31.2%) as the major reasons for non-ownership and non-usage of ITNs. The knowledge, attitude and Perception revealed that 91.4% cited mosquitoes bites as the main mode of transmission, 51.5% prefer insecticide spray as their means of control while 65.3% uses drugs as treatment remedy. The study also showed that 26.5% of those who reported having ITNs had malaria parasite while 16.3% who reported usage of ITNs every night were positive. 60.42% of the respondents reported acquiring their ITNs through free distribution while 23.18% reported obtaining theirs from market/clinic. Vector study was carried out and mosquitoes were collected using the pyrethrum knockdown collection techniques, 146 mosquitoes were recovered from the study with urban area having a greater number of mosquitoes caught in rooms (94) with a room density of 2.3 at against rural area (52) with room density of 1.6. This study revealed the prevalence of malaria in Makurdi and Orokam, which shows that malaria is endemic and stable in Nigeria in different zones of the country and is a major cause of morbidity and mortality and particularly affects children under 5 years. There is therefore need for more awareness on effective use of drugs and insecticides treated bed nets in malaria treatment and control
Key words: *Parasite, Mosquito, Malaria, questionnaire and plasmodium*

Date of Submission: 12-03-2022 Date of Acceptance: 28-03-2022

I. Background of Study

Malaria is a mosquito-borne infectious disease of humans and caused by parasitic protozoans (a group of single-celled microorganism) belonging to the genus Plasmodium (Malaria Fact sheet, 2014). It causes symptoms that typically include fever, fatigue, vomiting and headaches. In severe cases it can cause yellow skin, seizures, coma or death (Caraballo, 2014). The disease is transmitted by the biting of mosquitos, and the symptoms usually begin ten to fifteen days after being bitten. In those who have not been appropriately treated disease may recur months later (Malaria Fact sheet, 2014). In those who have recently survived an infection, re-infection typically causes milder symptoms. This partial resistance disappears over months to years if there is no ongoing exposure to malaria (Caraballo, 2014).

Malaria is transmitted most commonly by an infected female *Anopheles* mosquito. The mosquito bite introduces the parasites from the mosquito's saliva into a person's blood (Malaria Fact sheet, 2014). The parasites then travel to the liver where they mature and reproduce. Five species of *Plasmodium* can infect and be spread by humans (Caraballo, 2014). Most deaths are caused by *P. falciparum* because *P. vivax*, *P. ovale*, and *P. malariae* generally cause milder form of malaria (Malaria Fact sheet, 2014; Caraballo, 2014). The species *P. knowlesi* rarely causes disease in humans but have been known to cause disease in monkeys (Malaria Fact sheet, 2014).

In sub-saharan Africa, five *Anopheles* mosquito species namely *Anopheles gambiae, A. arabiensis, A. funestus, A. nili and A. mouchetti* have been described as major vectors of regional importance while about 9 other species are secondary or local vectors. *Anopheles* mosquitoes differ remarkably in their distribution habitats and habits (Gillies and de Meillon, 1968, Oyewole *et al.*, 2007). Gordon and Lavoipierre (1976) observed that almost every species of *Anopheles* mosquito has its own requirements as regards to the physical

conditions of the larval habitats. Sometimes these requirements are similar for different anopheline species but others have such highly specialized requirements that it is unusual to find them in association with other species and therefore useless to search for them in more commonly favoured habitats. Apart from the differences in their ecological habitats, adult female mosquitoes generally differ in their behavior especially biting habits including host blood meal preferences, time and place of biting and resting sites, which are very important in the epidemiology of disease transmission. Sometimes, mosquitoes are strictly zoophilic (feeding on animals only) or strictly anthropophilic (biting humans only), while others bite both man and animals indiscriminately. Also some mosquitoes bite and rest indoors (endophagic and endophilic) but others bite and rest outdoors (exophagic and exophilic). Furthermore, some mosquitoes are crepuscular and nocturnal and others are diurnal (Service, 1993).

The risk of disease can be reduced by preventing mosquito bites by using mosquito nets and insect repellents, or with mosquito-control measures such as spraying insecticides and draining standing water (Caraballo, 2014). The success of malaria control with ITNs has been bogged down by problems of delivery, distribution, usage and even acceptability of this method in Africa (D'Alessandro, 1997). Public awareness and acceptance of insecticide treated nets varies from community to community in countries where this method of malaria control has been adopted. Several medications are available to prevent malaria in travellers to areas where the disease is common. Occasional doses of the medication sulfadoxine/pyrimethamine are recommended in infants and after the first trimester of pregnancy in areas with high rates of malaria. Despite the need, no effective vaccine exists, although efforts to develop one are ongoing (WHO, 2014). The recommended treatment for malaria is a combination of antimalarial medications that includes an artemisinin (Malaria Fact sheet, 2014; Caraballo H, 2014). The second medication may be either mefloquine, lumefantrine, or sulfadoxine/pyrimethamine (WHO, 2010). Quinine along with doxycycline may be used if an artemisinin is not available (WHO, 2010). It is recommended that in areas where the disease is common, malaria is confirmed if possible before treatment is started due to concerns of increasing drug resistance. Resistance has developed to several antimalarial medications; for example, chloroquine-resistant *P. falciparum* has spread to most malarial areas, and resistance to artemisinin has become a problem in some parts of Southeast Asia (WHO, 2014). The disease is widespread in tropical and subtropical regions that are present in a broad band around the equator (Caraballo, 2014). This includes much of Sub-Saharan Africa, Asia, and Latin America. Malaria is commonly associated with poverty and has a major negative effect on economic development (Gollin and Zimmermann, 2007, Worrall *et al*., 2005). In Africa it is estimated to result in losses of US$12 billion a year due to increased healthcare costs, lost ability to work and effects on tourism (Greenwood *et al*., 2005). The World Health Organization reports there were 198 million cases of malaria worldwide in 2013(WHO, 2014, GBD, 2014). This resulted in an estimated 584,000 to 855,000 deaths, the majority (90%) of which occurred in Africa (WHO, 2014; World malaria report, 2014).

In Nigeria, malaria is endemic and stable with seasonal variation in different zones of the country and is a major cause of morbidity and mortality and particularly affects children under 5 years (Federal Ministry of Health, F.M.H., 2005, Okeke *et al.*, 2006, Orimadegun *et al.*, 2007). More than 90% of the population is at risk of malaria and at least 50% of the population suffers from at least one episode of malaria each year. Tragically the health status of children under five and of women has remained a major barrier to Nigeria's development. It is estimated that about 100 children under one year and 203 children under five years out of 1000 respectively die annually of malaria (Nigeria Demographic and Health Survey, N.D.H.S., 2003). In other-words one out of every five Nigeria children dies before his or her 5th birthday (Roll Back Malaria, R.B.M., 2000). Among pregnant women, malaria is responsible for more than one in ten deaths and accounts for considerable proportion of low-birth-weight babies born to these mothers (FMH 2005). Beyond the impact on children and pregnant women it affects the general population (RBM 2005, FMH 2005).

Almost 3% of disability adjusted life years are due to malaria mortality globally and 10% in Africa (Breman *et al.,* 2004). The economic burden of malaria illness on households account for almost 50% of total economic burden of illnesses in malaria holoendemic communities (Uzochukwu and Onwujekwu, 2004). Living in malaria endemic region places an economic burden on households even if they do not actually suffer an episode of malaria, and reducing malaria improves household's living standards (Laxminnarayan, 2004). Given that malaria is

endemic throughout Nigeria and that over 50% of the country's population is living below poverty line, malaria incidence may increase significantly in Nigeria because many may not be able to afford the newly introduced drugs due to poverty (Yusuf *et al.*, 2010). Finally, the direct and indirect cost of malaria rose to $13 billion in 1997 with Africa taking the brunt of the burden, while spending on research, prevention and control worldwide probably amounts to no more than $2 billion (WHO, 1998). Several factors have been reported to influence the vectorial role of mosquitoes in disease transmission like abundance, biting behaviour, host preference and longetivity (Noutcha and Anumudu, 2009). A full understanding of these factors is a prerequisite in planning effective vector control programmes. The increase in environmental modification as a result of

urbanization is usually being accompanied by creation of more breeding sites for mosquitoes which most often lead to the increase in the incidence of mosquito-borne diseases (Amusan *et al*., 2005).

Any attempt to prevent or control a disease such as malaria in any area or in a locality should first of all be preceded by an extensive evaluation of the magnitude of the prevailing situation. Malaria negatively impacts the social and economic development of communities in Nigeria. It is responsible for school absenteeism and low productivity at work places and on farms. Given the human and financial toll malaria is taking on societies throughout the world, continued research on ways to prevent and treat malaria is essential.

This study is aimed at determining the Epidemiology of Malaria in an Urban and a Rural Area of Benue State. To achieve this aim various objective were met which includes the determination and comparison of the current status of malaria in urban and rural areas in the state, assessment of the people's knowledge of malaria, its transmission, treatment, prevention and control., also to assess the people's knowledge of Insecticide Treated Nets (ITN) and its usage and finally, to determine the mosquito species available in the study area.

II. Materials and Methods

Study area

The study was carried out in Benue state which is in the mid-belt region of Nigeria. It was done in 2 Local government area in the state which are; Makurdi Local Government Area of Benue State and Orokam in Ogbadibo Local Government Area. The people of Makurdi local government area are mostly fisher men and farmers who produce yam, Rice, Beans, Cassava, Sweet-potato, Maize, Soya bean, Sorghum, Millet, Sesame, cocoyam etc.Its coordinates are longitude $7^{o}43'$ - north and latitude $8^{o}32'10''$ - east. The town is divided by the River Benue into the north and south banks. Ogbadibo is a local government area in Benue State, Nigeria. The local government area is made up of three major districts. These include Otukpa, Orokam and Owukpa.Ogbadibo. Ogbadibo local government area has Otukpa as its headquarters and have a land mass of about 550sq km with population of over 130,988 people (2006 census). Its coordinates is Latitude 7.0892° or 7° 5' 21.2" north Longitude 7.6499° or 7° 38' 59.6" east. Over 80% of the people in the district engage in farming.

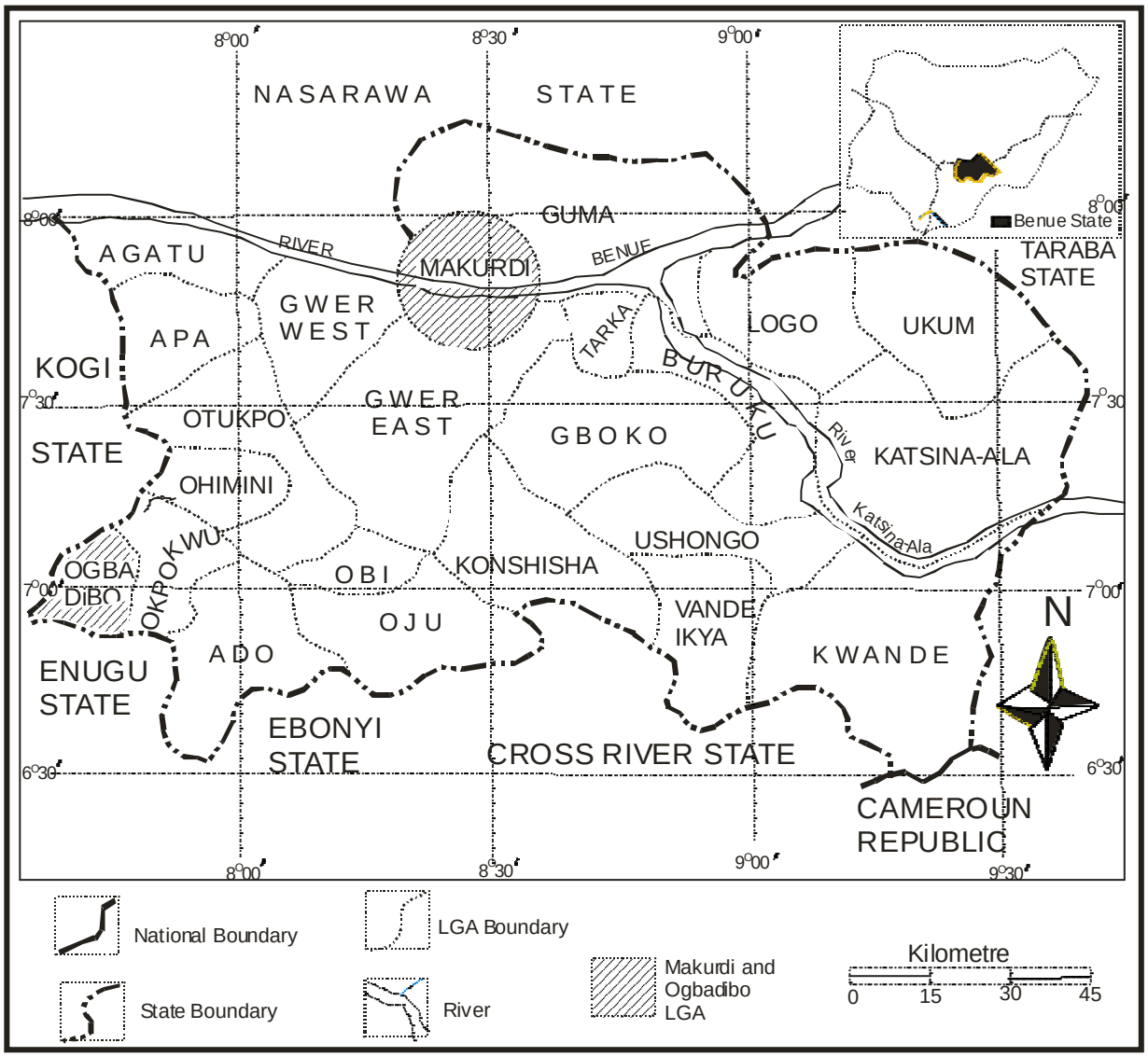

Figure 1: Map of Benue State Showing Makurdi and Ogbadibo Local Government Areas.

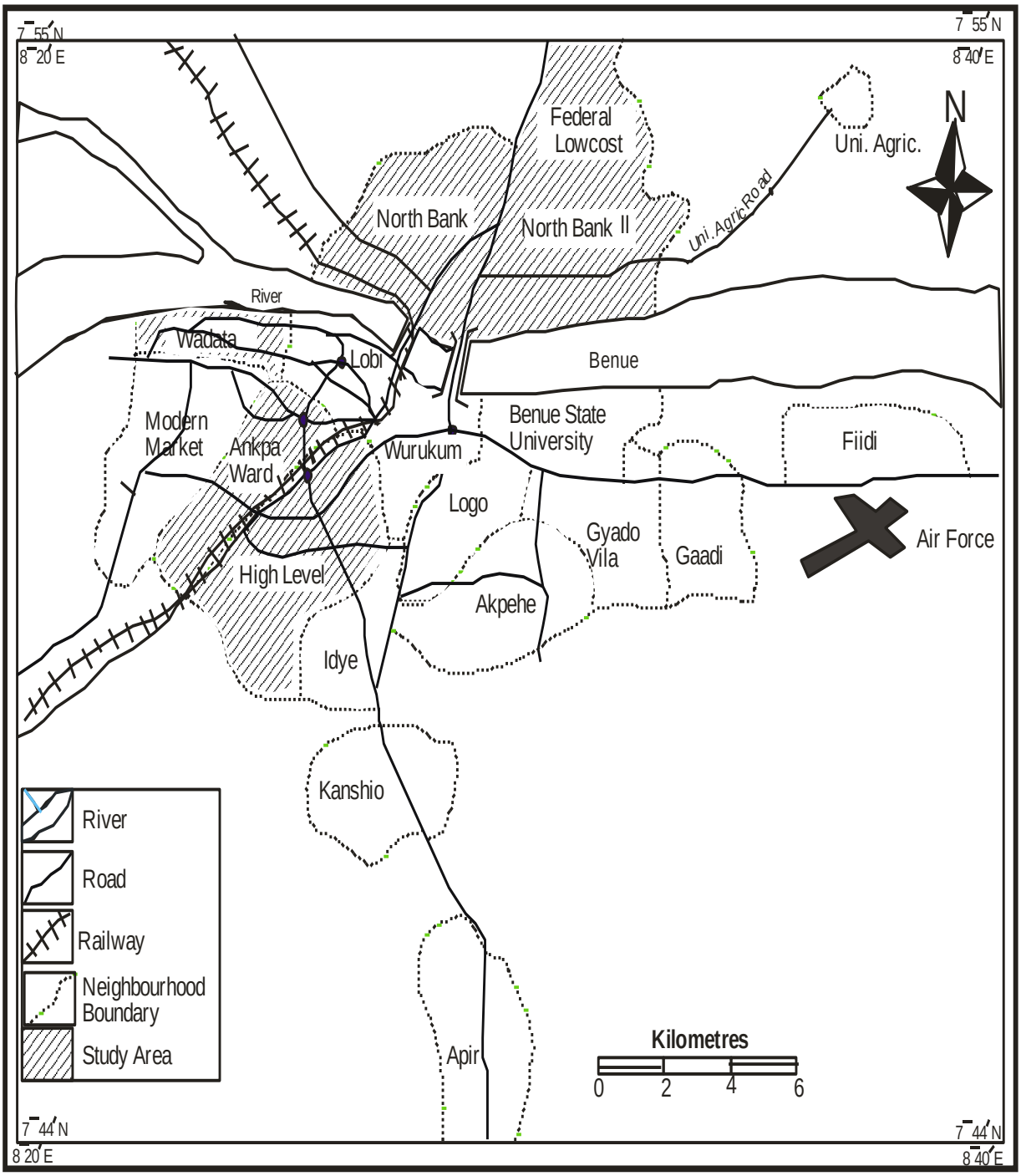

Figure 2: Map of Makurdi Showing Study Areas.

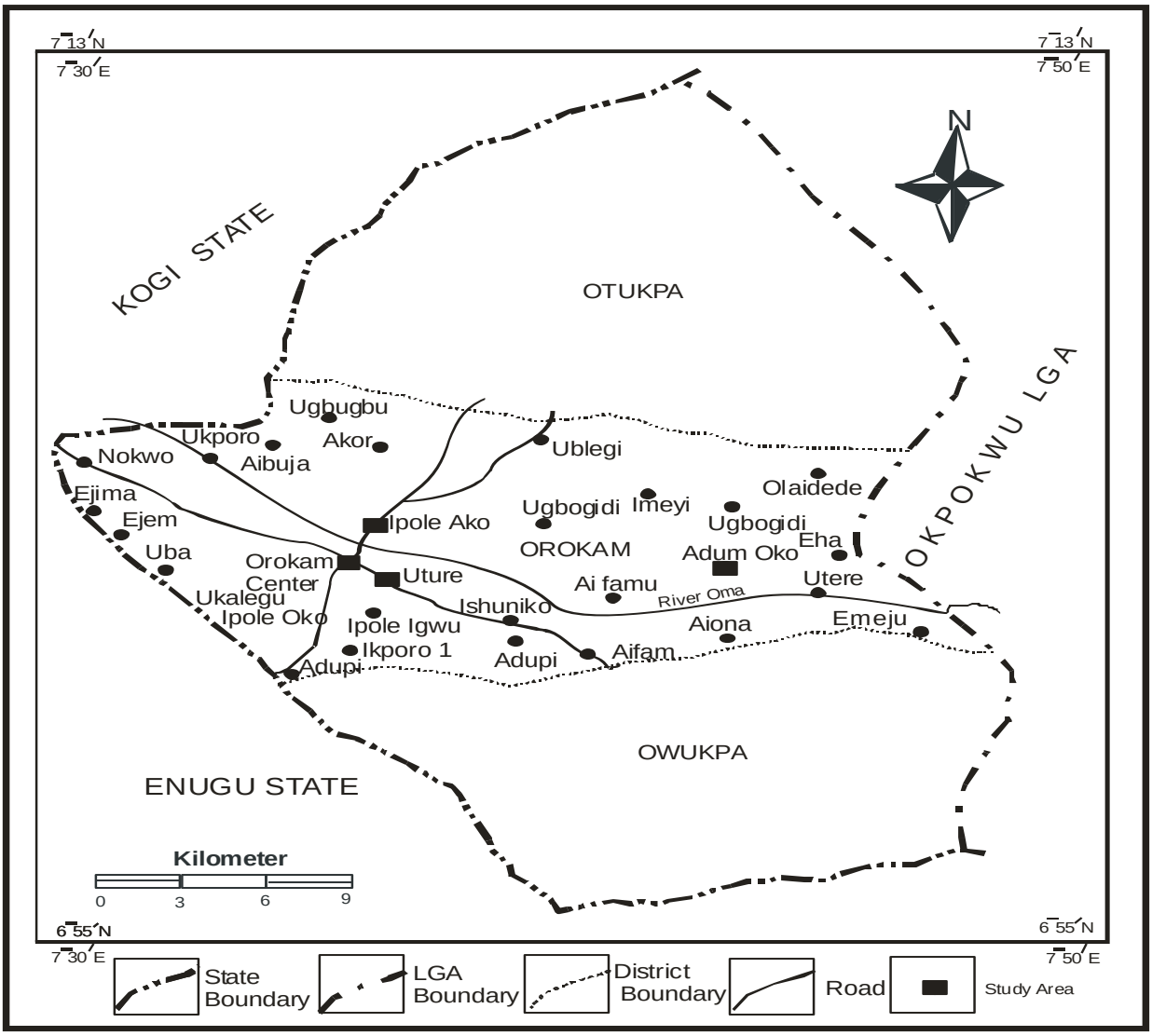

Figure 3: Map of Orokam Showing Study Areas.

Ethical consent.

Letter of introduction was obtained from the department of Biological Sciences, Benue State University, Makurdi which was subsequently taken to the Benue State Ministry of Health and a written permission was obtained which was then taken to the local government councils (Makurdi and Ogbadibo). The individuals that were involved were sensitized and their consent obtained before they partook in the study.

Study population

The sample size was estimated using www.raosoft.com (sample size calculator)

Initial population =590,797

Level of Significance = 5% 0r (0.05=p)

Three hundred and eighty four individuals, comprising of 200 individuals from the urban and 184 from the rural communities constituted the study/research population, cutting across all ages and both sexes were selected. Questionnaires were administered to each participant and blood samples collected was labeled, analyzed using RDT kits and recorded properly to avoid mix up.

Sampling Site

For the purpose of this research, Makurdi main town was divided into four sampling sites, comprising of North bank, Ankpa Ward, Wadata and High/level. In these locations at least three major streets was selected as sampling sites. In Ogbadibo local government area, Orokam district was used as the sampling site comprising of Adum Oko, Orokam Center, Uture and Ipole Ako, households were selected randomly.

Study Design and Sampling

Two types of data were collected.

1. Collection of information on the demographic, geographical, socioeconomic, knowledge, attitude and practice of participants using structured questionnaires.
2. Collection of information on malaria prevalence using rapid diagnostic technique.

Use of Questionnaires

Structured questionnaires were used to collect information about the socioeconomic and geographical location of each respondent. In case of infants, their mother or person that brought them was interviewed. The questionnaire was administered to each participant and was collected back immediately to ensure 100% returns. Included in the questionnaire were variables such as age, sex, education, occupation, etc as seen in Appendix.

Parasitological Technique

The Cassette Rapid diagnostic Test was employed in the diagnosis of malaria antigen using the finger prick blood collection method.

Principle of the Cassette Malaria Rapid Diagnostic Test (RDT)

- Malaria Rapid Diagnostic Tests are qualitative immunochromatographic lateral flow tests in cassette that detects malaria antigen in peripheral blood. (Cheesbrough, 2005).
- Malaria antigen from a lyzed blood sample is reacted with anti-malaria monoclonal antibody conjugated to colloidal gold (pink) particles.
- The antigen-antibody colloidal gold complex migrates along the nitrocellulose membrane where it becomes bound (captured) by a line of specific monoclonal antibody, producing a pink colour in the test result area. This line can be seen after a washing buffer has removed the background hemoglobin. (Cheesbrough, 2005).

Sample Collection

The sample collected for this research is a peripheral blood and the method of collection is the finger prick method as described by (Cheesbrough, 2005).

Materials

The Cassette malaria Rapid Diagnostic Test (RDT) kit containing Blood transfer device and Running buffer.Other essential ancillary commodities include: Lancet, Alcohol swabs, Gloves, Swabs and sharps disposal containers, Biohazard bags.

Procedures

The packet was opened and the Test, Capillary, Desk count sachet removed. The participant's name was written on the test to avoid mix up. Alcohol swab was opened, taking the fourth finger of the participant's left hand; the finger was cleaned with alcohol swab and allowed to dry before pricking. Lancet was opened and the participant's finger pricked to get a drop of blood. The lancet was not allowed to touch anything before using. The lancet was disposed in the sharps disposal container immediately. The capillary tube provided was then used to collect the blood. Using the capillary tube, the blood was dropped into the square hole marked "A". The capillary tube was then discarded into the sharp's container. Buffer was added into the round hole marked "B". The test was then ready to be read after 15 minutes.

How to read the result

Positive: A line near letter "C" and a line near letter "T" mean the patient is positive for malaria.

Negative: A line near "C" and no line near "T" mean the patient is negative for malaria.

Invalid result: No line near "C" and one or no line near letter "T" mean the test is invalid and has to be repeated.

Vector study

Collection of Indoor biting and resting adult mosquitoes

Indoor biting and resting adult mosquitoes were collected from different randomly selected houses in each study area (urban and rural) using pyrethrum (insecticide) knockdown collection techniques (PKC). One room was selected from each household based on the occupant's cooperation. Cloth sheets were used to cover the floor of each room in order to collect dead or weak mosquitoes.

The clothes were laid from wall to wall and were made to overlap with each other at the centre of the room to avoid escape of falling mosquitoes. Open eaves were properly covered where present and the windows and doors were properly shut and the whole room sprayed with Insecticide aerosol commonly available in the local markets. After 20 minutes of fleeting each room, the doors and windows were opened and the cloths were folded starting from edges to ensure that all fallen mosquitoes concentrated at the centre. The mosquitoes were then taken to the open space where they were opened and all collected into vials.

Identification and Scoring of Mosquitoes

Identification and scoring of mosquito was done microscopically with the aid of the taxonomic keys from Gillies and Coetzee (1987) and Gillies and De Meillion (1968) was used to identify Anopheline and Culicine mosquitoes to species level.

Identification was based on gross external morphology, appearance of the antennae, palps, proboscis, thorax, terminal abdominal segments, wings and hind legs colour and striations on the body by comparing mosquito parts and identification of features with published keys.

Statistical analysis

The data were pooled across the four urban areas in Makurdi (Wadata, North bank, High level and Ankpa ward) and four rural areas in Orokam (Orokam center, Uture, Adum oko and Ipole ako), so as to yield urban and rural data sets which were then subjected to statistical analysis. Chi square was used to test for significant differences at 0.05 Level of significance.

Where the chi-square calculated is greater than the chi-square tabulated variables are considered as statistically significant. Prevalence rate was calculated using simple percentage.

III. Results

A total of 384 individuals took part in the research, out of which 200 are from urban area (Makurdi) and 184 from rural area (Orokam). Of the 200 persons examined in urban area, 58(29.0%) were positive for malaria parasite while 64(34.7%) were infected in the rural area (Table 1).

The gender specific infection rate showed that males had the higher infection rate 36.6% than females 27.9% as shown in table 2. The study according to age showed that age group 1-5 years had the highest infection rate 41.2% followed by 6-10 with infection rate of 38.9% (Table 3).

Structured questionnaires were administered to assess the malaria related knowledge. The reason for non-ownership and non-usage of insecticide treated nets are summarized in table 4. Reason why some don't own ITNs 80(20.8%) complained of inaccessibility while 145(37.7%) said theirs are damaged. 120(31.2%) cited inconvenience while 27.6% cited causes heat as their reason for non-usage. Table 5 assessed their knowledge on the mode of action of ITNs in preventing malaria transmission, majority 158(41.1%) responded that it serves as a physical barrier while other 131(34.1%) says it kill mosquito.

The knowledge, attitude and perception on the mode of transmission, control strategy and best malaria remedy are summarized in table 6. (91.4%) responded that malaria is transmitted by mosquito bites, (51.5%) cited insecticide spray as their preferred means of mosquito control. The malaria management practice showed that 65.3% uses drugs while 32.2% uses herbs. Table 7 shows prevalence of malaria in relation to ITNs ownership and it was observed that 26.5% of those that reported ownership were positive for malaria parasite while 35.7% of those that reported non-ownership were positive. 16.3% of those that reported usage of ITNs were positive for malaria infection while 35.3% that reported non-usage were infected (Table 8). The study also revealed that most of the respondents 60.42% acquired their ITNs through free distribution while 23.18% obtained theirs from market/clinic (Figure 8).

The abundance and distribution of mosquito species varied in the various towns and in both urban and rural areas. Urban area had a greater number of mosquito caught in rooms (94) and had a room density of (2.3) against rural area (52) with room density of (1.6). Of the 146 mosquitoes caught majority were *Culex quinquefaciatus* 57(39.0%) followed by *Aedes aegypti* 40(27.3%) and *Anopheles gambiae* 35(23.9%) as shown in table 9.

Table 1: Prevalence of malaria in the study area.

Location	No. Examined	No. Infected (%)
Urban Areas		
High level	50	8 (16.0)
Wadata	50	21 (42.0)
North Bank	50	17 (34.0)
Ankpa Ward	50	12(24.0)
Sub-total Urban	**200**	**58 (29.0)**
Rural Areas		
Adum Oko	50	18 (36.0)
Uture	50	16 (32.0)
Orokam Center	45	16 (35.5)
Ipole Ako	39	14 (35.8)
Sub-total Rural	**184**	**64 (34.7)**
Grand Total	**384**	**122 (31.7)**

(X^2 calc = 1.733, < X^2 tab = 3.84, df = 1, P > 0.05)

Table 2: Prevalence of malaria according to sex

Gender	No. Tested	No. Infected (%)
Male	169	62 (36.6)
Female	215	60 (27.9)
Total	**384**	**122 (31.7)**

(X^2 Calc = 3.118, < X^2 tab = 3.841, df = 1, P > 0.05)

Table 3: Prevalence of malaria in relation to age groups in the study area.

Age Group	Urban Areas		Rural Areas		Total	
	No. Examined	No. Infected(%)	No. Examined	No. Infected(%)	No. Examined	No. Infected(%)
1-5	32	13(40.6)	31	13(41.9)	63	26(41.2)
6-10	34	11(32.3)	25	12(48.0)	59	23(38.9)
11-15	23	5(21.7)	30	7(23.3)	53	12(22.6)
16-20	25	7(28.0)	19	6(31.5)	44	13(29.5)
21-25	22	6(27.2)	28	7(25.0)	50	13(26.0)
26-30	21	4(19.0)	14	6(42.8)	35	10(28.5)
31-35	13	5(38.4)	15	5(33.3)	28	10(35.7)
36-40	17	4(23.5)	12	4(33.3)	29	8(27.5)
41-above	13	3(23.0)	10	4(40.0)	23	7(30.4)
Total	**200**	**58(29.0)**	**184**	**64(34.7)**	**384**	**122(31.7)**

Table 4: Showing reasons for Non-ownership and Non-usage of ITNs in the study area.

	URBAN (Makurdi) (%)	RURAL (Orokam) (%)	TOTAL (%)
REASON FOR NON-OWNERSHIP			
Inaccessibility/Don't know where to buy.	36(18.0)	44(23.9)	80(20.8)
Too expensive/high cost.	17(8.5)	14(7.4)	31(8.0)
Do not know about ITNs.	27(13.5)	22(11.9)	49(12.7)
Damaged.	81(40.5)	64(34.7)	145(37.7)
Prefer other mosquito control strategies.	39(19.5)	40(21.7)	79(20.5)
REASON FOR NON-USAGE			
Inconvenience/sleeplessness	74(37.0)	46(25.0)	120(31.2)
Allergic to ITN	14(7.0)	28(15.2)	42(10.9)
Causes heat	58(29.0)	48(26.0)	106(27.6)
Ineffective	11(5.5)	12(6.5)	23(5.9)
It is meant for the dead	1(0.5)	8(4.3)	9(2.3)
No space to hang it	41(20.3)	37(20.1)	78(20.3)
No specific reason (ignorance)	1(0.5)	5(2.7)	6(1.5)
TOTAL	**200**	**184**	**384**

Table 5: Assessment of the Knowledge on the Mode of Action of ITNs in preventing Malaria Transmission.

RESPONSES	Urban (Makurdi) (%)	Rural (Orokam) (%)	TOTAL (%)
Physical barrier	81 (40.5)	77(41.8)	158(41.1)
Kills mosquito	70(35.0)	61(33.1)	131(34.1)
Irritates mosquito	39(19.5)	20(10.8)	59(15.3)
Do not know	10(5.0)	26(14.1)	36(9.3)
TOTAL	**200**	**184**	**384**

Table 6: KAP on the mode of transmission, control strategy and best malaria remedy

VARIABLE	Urban (Makurdi) (%)	Rural (Orokam) (%)	TOTAL (%)

MODE OF TRANSMISSION

Mosquito Bite	193(96.6)	158(85.8)	351(91.4)
Body contact with Infected Person	1(0.5)	3(1.6)	4(1.0)
Respiratory Route	0(0.0)	3(1.6)	3(0.7)
Witchcraft/Charm	3(1.5)	11(5.9)	14(3.6)
Don't Know	3(1.5)	9(4.8)	12(3.1)
MOSQUITO CONTROL STRATEGY			
Insecticide spray	101(50.5)	97(52.7)	198(51.5)
Clear all Stagnant Water	10(5.0)	8(4.3)	18(4.6)
Mosquito Coil	13(6.5)	24(13.0)	37(9.6)
Apply mosquito repellant cream	12(6.0)	2(1.0)	14(3.6)
Windows And Door Nets	13(6.5)	10(5.4)	23(5.9)
Insecticide Treated Nets (ITNs)	51(25.5)	43(23.3)	94(24.4)
BEST MALARIA REMEDY			
Drugs	132(66.0)	119(64.6)	251(65.3)
Traditional healers	2(1.0)	7(3.8)	9(2.3)
Herbs	66(33.0)	58(31.5)	124(32.2)
TOTAL	**200**	**184**	**384**

Table 7: Showing Prevalence of Malaria in Relation to ITN ownership in the study areas.

ITN Ownership	Urban (Makurdi) (%)		Rural (%) (Orokam)		Total (%)	
	No. of Respondents	Number Positive	No. of Respondents	Number Positive	Number of Respondents	Number Positive
YES	87(43.5)	20(22.9)	79 (42.9)	24(30.3)	166(43.2)	44(26.5)
NO	113(56.5)	38(28.5)	105(57.0)	40(38.0)	218(56.7)	78(35.7)
TOTAL	**200**	**58(29.0)**	**184**	**64(34.7)**	**384**	**122(31.7)**

(X^2 calc = 3.963 > X^2 tab = 3.841. df=1)

Table 8: Showing prevalence of malaria in relation to ITN Usage in the study area

ITN Usage	Urban (Makurdi) (%)		Rural(Orokam)(%)		Total (%)	
	Number examined	Number Positive	Number examined	Number positive	Number examined	Number positive
Every night **(consistently)**	30	4(13.3)	25	5(20.0)	55	9(16.3)
A few times **(inconsistent)**	46	16(34.7)	57	17(29.8)	103	33(32.0)
Never	124	38(30.6)	102	42(41.1)	226	80(35.3)
Total	200	58(29.0)	184	64(34.7)	384	122(31.7)

(X^2 Calc = 6.75, > X^2 = 5.99, df = 2, P < 0.05)

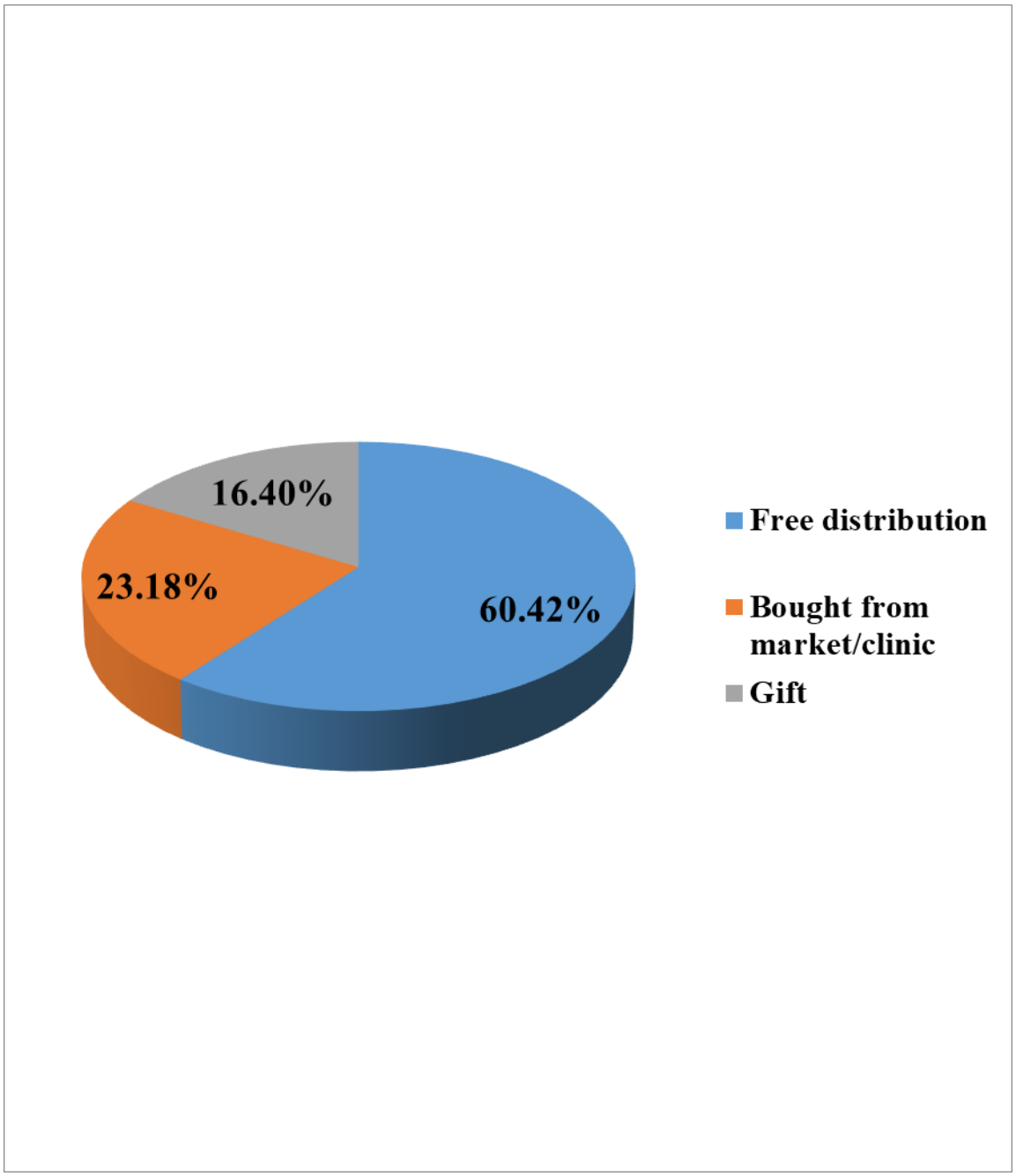

Figure 9: Respondent's source of ITNs

Table 9: Mosquito species collected from the study area

Location	Mosquito species	No. collected	Room Density
Urban			
High Level	*Culex quinquefaciatus* *Aedes aegypti* *Anopheles gambiae* *Anopheles funestus* **Total**	8 6 3 - **17**	0.8 0.6 0.3 - **1.7**
Wadata	*Culex quinquefaciatus* *Aedes aegypti* *Anopheles gambiae* *Anopheles funestus* **Total**	12 7 7 **4** **30**	1.2 0.7 0.7 **0.4** **3.0**
North Bank	*Culex quinquefaciatus* *Aedes aegypti*	10 7	1.0 0.7

	Anopheles gambiae	6	0.6
	Anopheles funestus	3	**0.3**
	Total	**26**	**2.6**
Ankpa Ward	*Culex quinquefaciatus*	8	0.8
	Aedes aegypti	6	0.6
	Anopheles gambiae	6	0.6
	Anopheles funestus	1	**0.1**
	Total	**21**	**2.1**
Urban Sub Total	*Culex quinquefaciatus*	38(40.4%)	0.9
	Aedes aegypti	26(27.6%)	0.7
	Anopheles gambiae	22(23.4%)	0.5
	Anopheles funestus	8(8.5%)	0.2
	Total	**94(100%)**	**2.3**
Rural			
Adum Oko	*Culex quinquefaciatus*	6	0.6
	Aedes aegypti	3	0.3
	Anopheles gambiae	4	0.4
	Anopheles funestus	**2**	**0.2**
	Total	**1.5**	**1.5**
Uture	*Culex quinquefaciatus*	5	0.5
	Aedes aegypti	5	0.5
	Anopheles gambiae	3	0.3
	Anopheles funestus	-	-
	Total	**13**	**1.3**
Orokam Center	*Culex species*	4	0.4
	Aedes aegypti	4	0.4
	Anopheles gambiae	3	0.3
	Anopheles funestus	1	0.1
	Total	**12**	**1.2**
Ipole Ako	*Culex quinquefaciatus*	4	0.4
	Aedes aegypti	2	0.2
	Anopheles gambiae	3	0.3
	Anopheles funestus	3	0.3
	Total	**12**	**1.2**
Rural Sub Total	*Culex quinquefaciatus*	19(36.5%)	0.4
	Aedes aegypti	14(26.9%)	0.3
	Anopheles gambiae	25(25.0%)	0.3
	Anopheles funestus	6(11.5%)	0.1
	Total	**52(100%)**	**1.3**
Grand Total	***Culex quinquefaciatus***	**57(39.0%)**	**0.6**
	Aedes aegypti	**40(27.3%)**	**0.5**
	Anopheles gambiae	**35(23.9%)**	**0.4**
	Anopheles funestus	**14(9.5%)**	**0.1**
	Total	**146(100%)**	**1.6**

IV. Discussion

Result from this study showed that malaria is endemic in both Makurdi Township and Orokam village in Ogbadibo Local government area of Benue State. This is still a major health issue in these areas. This also correlates with Agomo *et al* (2009), Okeke *et al* (2006), WHO (2005, 2006, 2009) and FMH (2005) that malaria is both stable and endemic in Nigeria.

The overall prevalence of plasmodium infection in the study areas (31.7%) is lower than some reported results such as Ojiezeh *et al* (2000) who reported 71.2% in Southwest Nigeria, Nwosu *et al* (2010) who reported 86.7% in Ohaji, Imo State, Ukpai and Ajoku(2001) reported 85.5% in Okigwe and 75.00% in Owerri both in Imo state, 73.30% was reported by Oparaocha, 2003 in Ikwuono Abia State, Adefioye *et al* (2007) reported 72% prevalence rate in Oshogbo and 93.33% in Abia and 80.39% in Umuahia by Kalu *et al.*, 2012. Other reports are those of Olasehinde *et al* (2015) who reported 61.1% in South western Nigeria, Iwuora (2012) who reported 64.9% in Anambra State and 64.0% as reported by Nmadu *et al* (2015). The result however correlate some reports such as those of Bawa *et al* (2014) who reported incidence rate of 36.5% in Katsina State, Usip and Udofia (2010) reported 49.3% prevalence rate in Uyo and 46% by Umeaneato *et al* (2006) in Nnewi.

The comparative study between the various location shows that malaria prevalence was higher in the rural areas (34.7%) than in urban areas (29.0%). This may be due to ready availability of prevention and control tools in urban areas such as insecticide treated nets, Insecticide spray, knowledge of malaria and its prevention. The high prevalence of malaria in urban areas may be due to the extent in urbanization, availability of breeding places for malaria vectors, overcrowding and the behavioural attitude of the inhabitants of the areas among others. These is according to the reports that there has been marked increase in the number and size of towns and cities in many developing countries without corresponding increase in such services such as proper

sanitation and good drainages that inhibit the breeding of vectors of malaria (Fonterille and Simard, 2004). However, the difference in this case was not significant (X^2 calc = 1.733, < X^2 tab = 3.84, df = 1, P > 0.05).

Our study showed that males had higher malaria prevalence than females. This agrees with reports made by Nmadu *et al* (2015) and Abdullah *et al* (2009). According to Krogstad (1996) females are more immune to parasitic diseases and this is due to genetic and hormonal factors. The higher rate of prevalence could also be due to the fact that males are more engaged in out-door activities which make them more vulnerable to bites from infective mosquitoes as compared to the female counterparts.

The study reported higher prevalence rate of plasmodium among children of age group 1-5 and 6-10 years which corresponds with earlier studies by WHO, 2005, Nmadu *et al* (2015), Umar and Hassan (2001) and Olasehinde *et al* (2015) who reported 70.80% in children 1-5 years. This may be due to the fact that at that age, their immunity to parasitic infections has not been developed fully. However it has been established that residual immunity derived from the mother could be very effective in younger children but environmental conditions and inability to ward off mosquito attacks predispose them to malaria attack.

The study also showed that four major species of mosquitoes were recovered from the study areas; which are the *Culex quinquefaciatus, Aedes aegypti, Anopheles funestus* and *Anopheles gambiae*. Species of mosquitoes recovered in the study has also been reported in some studies such as Adeleke, 2008, Onyido *et al*, 2009 and Okogun *et al* 2005. The finding of *Anopheles species* in the study areas is of great importance because they are established vectors of malaria in Nigeria (Adeleke, 2008). *Culex species* are known vectors of bancroftian filariasis and *Aedes species* are proven vectors of arboviruses and yellow fever.

The report showed that mosquitoes recovered from the urban areas were more than those recovered from the rural areas. The presence of more mosquitoes in urban areas could be due to the fact that most urban areas of developing countries have poor housing, lack proper sanitation and lack proper drainage of surface water which could likely increase vector breeding and human vector contact and thus pose exclusive challenges to malaria control (UN, 2002; World population, 2006; Martens *et al*, 2000).

Insecticide treated nets (ITNs) is found to be one of the most effective prevention material for malaria. The study showed a 43.2% ITNs ownership which is higher than earlier report such as the Nigerian Demographic and Health Survey (NDHS) (2003) which reported 12% of bed net ownership and 2% ITNs in Nigerian households as at 2003. In 2008, NDHS reported an increase of bed net ownership to 17% and ITNs ownership increased to 8%. FMH in 2003 reported 11.8% ITNs ownership. This increment in ITNs ownership as reported in this study may be due to the fact that there has been increased awareness through radio and television jingles. Also there has been free ITNs distribution by government and different Non-governmental organisation in the state and across the nation, an exercise which is going on. The report also showed a slight difference in net ownership between the various locations; urban (43.5%) while rural (42.9%). The difference in ownership could be because urban areas have more health care facilities, easy access and have more acceptability rate due to awareness than rural areas.

Even though free net had been distributed in the study areas, usage is still relatively low. Major reasons for non-usage include; harsh weather, irritation while using it, inconvenience, lack of space and ignorance. These relates with Noor *et al* 2006, Alaii *et al* (2003) and Craig *et al* (1999).

The result also showed that 26.5% of people that reported ownership ITNs had malaria while 16.3% of those that reported usage of ITNs every night had malaria parasite. This level of prevalence may be due to improper usage of the nets or they were being exposed to infectious bite during the day's activities.

The result from the study also revealed that high percentage of the respondents (91.4%) attributed malaria to mosquito bite. Knowledge on mode of transmission varies reasonably among age groups, different educational level and socio status. This agrees with Bawa *et al* (2014) which reported 93.4% respondents' knowledge of malaria transmission.

V. Conclusion

This study revealed the prevalence of malaria in Makurdi and Orokam, which shows that malaria is endemic and stable in Nigeria with seasonal variation in different zones of the country and is a major cause of morbidity and mortality and particularly affects children under 5 years. The study also shows that insecticide treated nets are reliable and proven means of malaria prevention and more awareness has to be created about its proper usage and benefit. Continuous monitoring of the situation in Benue state and other parts of the country is needed to have a clear picture of the impact of intervention programs carried out so far. The findings also provides base-line information for evidence based planning and implementation of malaria control activities in the state by government, their agencies and nongovernmental organization. The vector study shows a high amount of *culex species* which can be very useful in vector control.

VI. Recommendations

1. Greater attention should be paid to population living in rural areas, towns and villages where there are no secondary or specialize health care facilities. Such areas should be designated as high priority targets for malaria intervention and control programs. These efforts should be doubled during the malaria transmission season which coincides with the rainy season. Government should also ensure that these communities have access to quality and affordable ACTs considering it is currently the most potent weapon against malaria.
2. Public health education campaign for mothers and health care givers should be given to create awareness that may lead to reduction of vectors of malaria infection and control of the disease especially in young children.
3. More free or subsidized insecticide treated nets should be made available to the general public.
4. Children should be treated with anti-malaria drugs every 3 months to prevent malaria and to kill (if any) the early stage of malaria parasite.

References

[1]. Abdullahi, K., Abubakar, U. Adamu, T., Daneji, A. I., Aliyu, R. U., Jiy , N., Ibraheem, M. T. O. and Nata'ala, S. U (2009). Malaria in Sokoto, North Western Nigeria. African Journal of Biotechnology Vol. 8 (24):7101-7105.

[2]. Abdullahi, K., Abubakar, U., Daneji, A.I., Adamu, T., Abdullahi, Y.M.. Bandiya, H.M. and Hassan, S.W. (2010). Anopheles gambiae in Sokoto north western Nigeria. Nigerian Journal of Parasitology 31(2): 118-122.

[3]. Abdulla S., Kikumbih N., Massanja H., Mshinda H., Nathtan R., Savigny D., Armstrong-Schellenberg J. A. and Victoria C. (2001). Mosquito nets, poverty and equity in rural southern Tanzania, Ifakara Health Research and Development Centre, Tanzania

[4]. Abebe E, Mosanya ME, Amajoh C, Otsemobor O, Ezedinachi EW, Afolabi BM, et al. Nigeria roll back malaria consultative mission: essential actions to support the attainment of the Abuja targets. 2003, Oct. 20-25 (Last cited on 2001 Nov. 05)

[5]. Abeku TA (2007). "Response to malaria epidemics in Africa". Emerging Infectious Diseases **14** (5): 681–6.

[6]. Adefioye, O.A., Adeyeba, O.A., Hassan, W.O. and Oyeniran, O.A. (2007). Prevalence of malaria parasite infection among pregnant women in Osogbo, Southwest, Nigeria. American-Eurasia Journal of Scientific Research 2(1) 43-45.

[7]. Adeleke, M.A., Mafiana, C. F., Idowu, A.B., Adekunle, M.F. and Sam-Wobo, S.O. (2008). Mosquito Larval Habitats and Public health Implication in Abeokuta, Ogun State Nigeria. Tanzanian Journal of Health Research vol. 10(2): 103-107.

[8]. Agomo, C.O., Oyibo, W.A., Anorlu, R.I. and Agomo, P.U. (2009). Prevalence of malaria in pregnant women in Lagos, southwest Nigeria. Korea Journal of Parasitology 47(2):1179-183

[9]. Ahmed, S. G. Ibrahim, U. A. and Ibrahim, G. (2001). Prevalence and clinicalsignificance of malaria parasitaemia in blood donors in Maiduguri, Nigeria. Nigerian Journal of Parasitology, 22: 29 - 34.

[10]. Akande TM, Musa IO. Epidemiology of Malaria in Africa; Afri J Clin Experiment 2005; 9: 107-11.

[11]. Alaba, O. & Alaba, A. (2002) "Malaria in Children. Implications for the productivity of Female Caregivers in Nigeria". Proceeding of Annual Conference of the Nigerian Economic Society (NES).pp 395 -413

[12]. Alaba, O. & Alaba, A. (2006), "Malaria in Rural Nigeria: Implication for the Millennium Development Goal". African Economic Research Consortium. Narrobi. Kenya

[13]. Alaii, J.A., Hawley, W.A., Kolczak, M.S., Terkulie, F.O., Gimnig, J.E., Vulule, J.M., Odhacha, A., Oloo, A.J., Hahlen, B.L. and Philip-Howard, P.A. (2003). Factors affecting use of permethrin-treated bed nets during a randomized controlled trial in western Kenya. American Journal of Tropical Medicine and Hygiene 68: 137-141.

[14]. Amadi, A.N.C., Allison, O.L., Odebuani, A.C. and Umandu, S.C. (2010). Malaria and gastro -intestinal parasite co-infections and anaemia in children (0-14years). Book of Abstract. Parasitology and Public Health Society of Nigeria. No 24.

[15]. AMMP (1997). The policy implications of adult morbidity and mortality end of phase 1 report.

[16]. Dar es Salaam, Adult Morbidity and Mortality Monitoring Project, Dar es Salaam, Tanzania.

[17]. Amusan, A.A.S., Mafiana, C.F., Idowu, A.B. and Olatunde, G.O. (2005). Sampling mosquitoes with CDC light-traps in rice field and plantation communities in Ogun state, Nigeria. Tanzania Health Res Bull 7: 111–6.

[18]. Anumudu, C.C., Adepoju, A., Adeniran, M., Adeoye, O., Kassim, A., Oyewole, I. and Nwuba, R.I. (2006). Malaria prevalence and treatment seeking behavior of young Nigerian adults.Annals of African Medicine 15: 82-88.

[19]. Aribodor, D.N., Njoku, O.O., Eneanya, C.I. and Onyali, I.O. (2003). Studies on the prevalence of malaria and management practices in Azia community in Ihiala L.G.A. Anambra state Southeast Nigeria. Nigeria Journal of Parasitology 24:33-38.

[20]. Arnott A, Barry AE, Reeder JC (2012). "Understanding the population genetics of Plasmodium vivax is essential for malaria control and elimination". Malaria Journal **11**: 14.

[21]. Arrow KJ, Panosian C, Gelband H, Institute of Medicine (U.S.). Committee on the Economics of Antimalarial Drugs (2004). Saving Lives, Buying Time: Economics of Malaria Drugs in an Age of Resistance. National Academies Press. p. 141.

[22]. Audibert M., Josseran R., Josse R. and Adjidji A. (1990) Irrigation, schistosomiasis and malaria in the Logone Valley, Cameroon. American Journal of Tropical Medicine and Hygiene **42**: 550-560.

[23]. Ayorinde S.A. Insecticide-Treated Nets (ITNs) as a strategy in Roll Back Malaria at the grass root. West Afri J Pharm 2002; 15:29.

[24]. Baird JK (2013). "Evidence and implications of mortality associated with acute Plasmodium vivax malaria". Clinical Microbiology Reviews **26** (1): 36–57.

[25]. Baird, J. K., Purnomo, and T. R. Jones. (1992). Diagnosis of malaria in the field by fluorescence microscopy of QRC capillary tubes. Transactions of the Royal Society of Tropical Medicine and Hygiene **86:**3-5.

[26]. Baragatti, M., Fournet, F., Henry, M.C., Assi, S., Ouedraogo, H., Rogier, C and Salem, G.

[27]. (2009).Social and environmental malaria risk factors in urban areas of Ouagadougou, Burkina Faso. Malaria Journal 8(1):13.

[28]. Bartoloni A, Zammarchi L (2012). "Clinical aspects of uncomplicated and severe malaria"Mediterranean Journal of Hematology and Infectious Diseases **4** (1):

[29]. Beare NA, Taylor TE, Harding SP, Lewallen S, Molyneux ME (2006). "Malarial retinopathy: A newly established diagnostic sign in severe malaria". American Journal of Tropical Medicine and Hygiene **75** (5): 790–7.

[30]. Belkin, J. N. (1962). The mosquitoes of the South Pacific (Diptera, Culicidae). Berkeley,University of California Press, Vol. l, 608 pp.; Vol. ll, plates 1-412.

[31]. Betterton, C. and Gadzama, N. M. (1981). Effects of drought on public health in Saqua V. O. (ed). Ecological Disasters in Nigeria drought and desertification. Proceedings of 1987 National workshop on Ecological Disasters in Nigeria: Drought and Desertification Kano Sponsored by Federal Ministry of Science and Technology Lagos 386 pp.

[32]. Betson, M., Jawara, M., Awolola, T.S. (2009). Status of insecticide susceptibility in Anopheles gambiae s.l from malaria surveillance sites in the Gambia.Malaria Journal **8**:187.

[33]. Biritwum R. B., Welbeck J. and Barnish G. (2000) Incidence and management of malaria in two communities of different socio-economic level, in Accra, Ghana. Ann Trop Med Parasitol **94**: 771-8.

[34]. Bondi F. S. (1991) Childhood coma in Ibadan. Relationship to socioeconomic factors. Tropical and Geographical Medicine **43**: 288-292.

[35]. Boudin C., Robert V., Carnevale P. and Thomas P. A. (1992) Epidemiology of Plasmodium falciparum in a rice fileld and a savannah area in Burkina Faso. Comparative study on the acquired immunoprotection in native populations. Acta Tropica **51**.

[36]. Breman, J.C., Alilio, M.S. and Mills, A. (2004). Conquering the intolerable burden of malaria: what's new, what's needed. A summary. American Journal of Tropical Medicine and Hygiene 71(2): 1-15.

[37]. Breman, J., Mills, A., Snow, R., Steketee, R., White, N. & K. Mendis (2006) "Conquering Malaria. In Disease Control Priorities in Developing Countries", 2nd ed. Oxford University Press. New York.

[38]. Brockerhoff M & Brennan P (1998). The poverty of cities in developing regions. Population and Development Review 24, 75–114.

[39]. Brokerhoff M. and Hewett P. (2000) Inequality of child mortality among ethnic groups in sub-Saharan Africa. Bulletin of the World Health Organization **78**: 30-41.

[40]. Brown, A. W. A. and Pal, R. (1971) Insecticide resistance in arthropods. Geneva, WHO Monograph Series, No. 38 , 491 pp.

[41]. Bruce-Chwatt, L.J. (1986). Chemotherapy of Malaria. (Revised 2nd Ed). WHO Monograph Series No **27**, Geneva; pp.261.

[42]. Bruce- Chwatt, L.J. (1991). Essential Malariology . Heinemann Medical Books Ltd. London .pp 462.

[43]. Bruce-Chwatt, L. J. and de Zulueta, J. (1980). The rise and fall of malaria in Europe: a historico-epidemiological study. Oxford, University Press , 240 pp.

[44]. Bryan, J. H. (1973). Studies on the Anopheles punctulatus complex. Transactions of the Royal Society of Tropical Medicine and Hygiene, 67: 64-91.

[45]. Caraballo H (2014). "Emergency department management of mosquito-borne illness:Malaria, dengue, and west nile virus". Emergency Medicine Practice **16** (5).

[46]. Carrington, A. (2001), "Malaria: its Human Impact, Challenges and Control strategies in Nigeria". Harvard Health Policy Review. Nigeria. Volume 2, Nov. 2

[47]. Center for National Health Development in Ethiopia, Proposal for the Global Fund to Fight AIDS, Tuberculosis and malaria, second round. 2003

[48]. Chant S & Radcliffe AS (1992) Gender and Migration in Developing Countries. Belhaven Press, London.

[49]. Charlwood et al., 1998, Survival And Infection Probabilities of Anthropophagic Anophelines From An Area of High Prevalence of Plasmodium falciparum in Humans, Bulletin of Entomological Research, 87, 445-453

[50]. Charlwood, J.D., Smith, T., Lyimo, E., Kitua, A.Y., Masanja, H., Booth, M., Alonso, P.L.and Tanner, M. (1998). Incidence of Plasmodium falciparum infection in infants in relation to exposure to sporozoite-infected Anophelines. American Journal of Tropical Medicine and Hygiene 59: 243-251.

[51]. Cheesbrough M; (2005). District Labouratory Practice in Tropical Countries. Part1. Cambridge University Press. Ed.(2).

[52]. CHESTRAD (2000). Malaria, Povery and Health, Center for Health Services Training. Research and Development International

[53]. Chima, R.I., Goodman, C.A. & Mills, A. (2003), "The Economic Impact of Malaria in Africa:a Critical Review of the Evidence". Health policy, Vol. 63(1): Pp17-36

[54]. Clarke S. E., Bogh C., Brown R. C., Pinder M., Walraven G. E. and Lindsay S. W. (2001).Do untreated bednets protect agains malaria? Transactions of the Royal Society ofTropical Medicine and Hygiene **95**: 457-62.

[55]. Clarke, S.E., Brooker, S., Njagi, J.K., Njau, E., Estambale, B., Muchiri, E. & Magnussen, P.(2004), "Malaria morbidity among school children living in two area of contrasting transmission in western Kenya" AmJTrop Med. **71:**732-738.

[56]. "Climate Change And Infectious Diseases" (PDF). CLIMATE CHANGE AND HUMAN HEALTH— RISK AND RESPONSES. World Health Organization. WHO 2010, p. VI

[57]. Clyde DF. (1987) Recent trends in the epidemiology and control of malaria. Epidemiology Review, 9:219-243.

[58]. Coluzzi, M., Sabatini, A., Petrarca, V. and Di Deco, M. A. (1979) .Chromosomal differentiation and adaptation to human environments in the Anopheles gambiae complex. Transactions of the Royal Society of Tropical Medicine and Hygiene, 73: 483-497.

[59]. Craig, M.H., Snow, R.W. and Le Sueur, D. (1999). A climate based distribution model of malaria transmission in Sub-Saharan Africa. Parasitology Today 15: 105-111.

[60]. Cui L, Yan G, Sattabongkot J, Cao Y, Chen B, Chen X, Fan Q, Fang Q, Jongwutiwes S, Parker D,Sirichaisinthop J, Kyaw MP, Su XZ, Yang H, Yang Z, Wang B, Xu J, Zheng B, Zhong D, Zhou G (2012). "Malaria in the Greater Mekong Subregion: Heterogeneity and complexity". Acta Tropica 121 (3): 227–39.

[61]. Cunningham-Burley S (1990) Mothers' beliefs about and perceptions of their children's illness.In Readings in Medical Sociology (eds S Cunningham-Burley & N McKeganey). Routledge, London.

[62]. D'Alessandro, U. (1997). The Gambian National Impregnated Bed Net Programme: Evaluation of effectiveness by means of case control studies. Transactions of The Royal Society of Tropical Medicine and Hygiene 91(6) 638-642.

[63]. Darsie, R. F. and Ward, R. A. (1981). Identification and geographical distribution of the mosquitoes of North America, north of Mexico. (Mosquito Systematics Suppl. No.1).Fresno, American Mosquito Control Association, 313 pp.

[64]. Dash AP, Yadav RS. Insecticide treated nets - technological and operational challenges. Indian J Med Res 2008; 128: 231-2.

[65]. Demographic and Health Survey. Addis Ababa, Ethiopia; 2005.

[66]. de Savigny D., Mwageni E., Masanja H., Juma Z., Momburi D., Mkilindi Y., Mbuya C., Kasale H. and Reid G. (2002). Household wealth ranking and risks of malaria mortality in rural Tanzania. Third MIM Pan-African Malaria Conference, ICC, Arusha, Tanzania.

[67]. Dutta, H.M. and Dutta, A.K. (1978). Malaria ecology: a global perspective. Social Science and Medicine. Medical Geography **12**:69-84.

[68]. Edington, G. M. and Gillies, H. M. (1976). Protozoan diseases. In: Pathology in the tropics. Edington, G. M and Gillies, H. M. (EDS) 2nd Edition. Edward Arnolds, London: pp. 10 - 90.

[69]. Eisele TP, Keating J, Littrel M, Larsen D, Macentyre K: Assessment of insecticide-treated bed net use among children and pregnant women across 15 countries using standardized national surveys. America Journal of Tropical Medicine and Hygiene. 2009;80: 209-4. em.m.wikipedia.org/wiki/Benue state

[70]. Etusim P.E., Kalu C., Nduka F.O., Kalu E.C.,Melariri P.E., Nwoke M, and Aduaka A.C, 2013.

[71]. Studies on the Prevalence of Malaria Parasite among Children with Splenomegaly in Aba Metropolis, Abia State, Nigeria. Journal of Medical and Applied Biosciences. Vol.3;1: 57-60.

[72]. Eze, N.C.E., Nzeako, S.O. and Amadi, E.C. (2010). Malaria and urban schistosomiasis. Nigerian Journal of Parasitology 31(2): 68-72.
[73]. "Factsheet on the World Malaria Report 2014". World Health Orgnization. 2014. Retrieved 2February 2015.
[74]. Fairhurst RM, Wellems TE (2010). "Chapter 275. Plasmodium species (malaria)". In Mandell GL,Bennett JE, Dolin R (eds). Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases **2** (7th ed.). Philadelphia, Pennsylvania: Churchill Livingstone /Elsevier. pp. 3437–62.
[75]. Fantini B. (1994) Anophelism without malaria: an ecological and epidemiological puzzle. Parasitologia, 36(1-2): 83-106.
[76]. Faran, M. E. and Linthicum, K. J. (1981).A handbook of the Amazonian species of Anopheles (Nyssorhynchus) (Diptera: Culicidae). Mosquito Systematics, 13: 1-81.
[77]. Farid, M. A. (1956).The implications of Anopheles sergentii for malaria eradication programmes east of the Mediterranean. Bulletin of the World Health Organization, 15: 821 -828.
[78]. Faruk, H.M. and Adeoye, G.O. (2010). Malaria among out patients in Ikoyi area, lagos state. Book of Abstract. Parasitology and Public Health Society of Nigeria. No 61.
[79]. Fawole O. I. and Onadeko M. O. (2001) Knowledge and home management of malaria fever by mothers and care givers of under five children. West African Journal of Medicine 20:152-7.
[80]. Feachem RG, Phillips AA, Hwang J, Cotter C, Wielgosz B, Greenwood BM, Sabot O, Rodriguez MH, Abeyasinghe RR, Ghebreyesus TA, Snow RW (2010). "Shrinking the malaria map: progress and prospects". Lancet **376** (9752): 1566–78.
[81]. Federal Ministry of Health (FMH) (2003). Malaria control in Nigeria; a strategy for behavioural change communication. Publication of the department of public Health. F.M.H. Nigeria 27pp
[82]. Federal Ministry of Health (FMOH); Burden of Malaria in Nigeria; Nigeria Demographic and Health Survey 2003; pp 2-15.
[83]. Federal Ministry of Health (FMOH); Guidelines for the implementation of insecticide treated mosquito nets in Nigeria 2003; pp 11-24.
[84]. Federal Ministry of Health (FMOH): The Concept of ITNs Massive Promotion Awareness Campaign (IMPAC) Abuja. National policy for malaria control 2003; p11-21.
[85]. Federal Ministry of Health (2005), National malaria control program in Nigeria. Annual report. Abuja. Nigeria.
[86]. Federal Ministry of Health (FMH) (2005). National treatment guidelines, federal ministry of health. Publication of the FMH, Nigeria, pp 44.
[87]. Federal Ministry of Health (2007), National Frame work for monitoring and Evaluation of Malaria Control in Nigeria. FMOH,Abuja.
[88]. Federal Ministry of Health (2008). Manual for health workers on Integrated Vector Management (IVM) for malaria control in Nigeria..National Malaria and Vector Control Programme, Federal Ministry of Health Abuja, Nigeria.143pp.
[89]. Federal Ministry of Health (2009a). Policy on indoor residual spraying for malaria vectors in Nigeria..National Malaria Control Programme, Federal Ministry of Health. Abuja, Nigeria .22pp.
[90]. Federal Ministry of Health(2009b). Guidelines for the implementation of indoor residual spraying for malaria vectors in Nigeria..National Malaria Control Programme, Federal Ministry of Health. Abuja, Nigeria .22pp.
[91]. Ferri FF (2009). "Chapter 332. Protozoal infections". Ferri's Color Atlas and Text of Clinical Medicine. Elsevier Health Sciences. p. 1159.
[92]. Filmer D. (2001). Fever and its treatment among the more and less poor in sub-Saharan Africa. World Bank Development Research Group.
[93]. Fonterille D and F. Simard, 2004. Unravelling complexities in human malaria transmission dynamics in Africa through a comprehensive knowledge of vector population. Comp. Immunol. Microbiol. Infect. Dis; 27:357-375
[94]. Forattini, O. P. (1962). Entomologia Medica, Vols 1 & 2. Sao Paulo, University Press, Brazil.
[95]. Gadzama, N.M. (1983). Mosquito Vectors of the Sahel savanna and environmental development. Annals of Borno **1**: 99-104.
[96]. Gadzama, N.M. (1991). The role of Entomology in primary health care: vector population management in malaria control. Paper presented at the National Malaria Therapy Surveillance Network Zonal Workshop Lagos. 17pp.
[97]. Gallup, J.L. & Sachs, J.D. (2001), "The Economic Burden of Malaria". American Journal of Tropical Medicine and Hygiene 64:85-96
[98]. Gamage-Mendis A. C., Carter R., Mendis C., De Zoysa A. P., Herath P. R. and Mendis K. N.(1991) Clustering of malaria infections within an endemic population: risk of malaria associated with the type of housing construction. Am J Trop Med Hyg **45**: 77-85.
[99]. Gazin P., Robert V., Cot M.and Carnevale P. (1988) Plasmodium falciparum incidence and patency in a high seasonal transmission area of Burkina Faso. Transactions of the Royal Society of Tropical Medicine and Hygiene 82 : 50-55.
[100]. GBD 2013 Mortality and Causes of Death Collaborators (17 December 2014). "Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013". Lancet.
[101]. Gething PW, Patil AP, Smith DL, Guerra CA, Elyazar IR, Johnston GL, Tatem AJ, Hay SI (2011). "A new world malaria map: Plasmodium falciparum endemicity in 2010". Malaria Journal **10** (1): 378.
[102]. Ghebreyesus T. A., Witten K. H., Getachew A., Yohannes A. M., Tesfay W., Minass M.,Bosman A. and Teklehaimanot A. (2000) The community based malaria control programme in Tigray, northern Ethiopia. A review of programme set-up, activities, outcomes and impact. Parassitologia **42**: 255-90.
[103]. Gilles H. M. (1993). The malaria parasites. In Bruce-Chwatt's Essential Malariology edited. Gilles H. M. & Warrell D.A., pp. 12-34.
[104]. Gillies, M.T. and Coetzee, B.A. (1987). Supplementary to Anophelinae of Africa, South of Sahara (Afro-Tropical Region). Publication of the South Africa Institute of Medical Research 55;1-143.
[105]. Gillies, M . T. and de Meillon, B. (1968). The anophelinae of Africa south of the Sahara.
[106]. Johannesburg, South African Institute for Medical Research, Publication No. 54, 343 pp.
[107]. Githeko, A. K., Lindsay, S. W., Confalonieri, U. E., Patz, J.A. (2000). Climate change and vector borne diseases: a regional analysis. Bulletin of the World Health Organisation **78**:1136-1143.
[108]. Glik D, Ward W, Gordon A & Haba F (1989) Malaria treatment practices among mothers in Guinea. Journal of Health and Social Behaviour 30, 421–435.
[109]. Global Malaria Action Plan (GMAP), (2008) **For a Malaria free World.** Roll Back Malaria partnership (RBMP)
[110]. Gollin D, Zimmermann C (August 2007). Malaria: Disease Impacts and Long-Run Income Differences (PDF) (Report). Institute for the Study of Labor.
[111]. Goodman, C., Coleman, P. & Mills, A. (2000), "Economic analysis of malaria control in Sub-Saharan Africa"**.** London School of Hygiene and Tropical Medicine. Mimeo.

[112]. Gordon, R.M. and Lavoipierre, M.M.J. (1976). Entomology for students of medicine, 4th printing. Blackwell Scientific Publications Oxford Pp 43.
[113]. Gould STW (1998) African mortality and the new 'urban penalty'. Health and Place 4,171–181.
[114]. Greenwood B.M., Greenwood A.M., Bradley A.K., Tulloch S., Hayes R. and Oldfield F.S.J.
[115]. (1987b) Deaths in infancy and early childhood in a well-vaccinated, rural, West African population. Annals of Tropical Paediatrics, 7 : 91-99.
[116]. Greenwood BM, Bojang K, Whitty CJ, Targett GA (2005). "Malaria". Lancet **365** (9469):1487–98.
[117]. Greenwood B, Mutabingwa T (2002). "Malaria in 2002". Nature 415 (6872): 670– 2.
[118]. Guerra CA, Hay SI, Lucioparedes LS, Gikandi PW, Tatem AJ, Noor AM, Snow RW (2007).
[119]. "Assembling a global database of malaria parasite prevalence for the Malaria Atlas Project". Malaria Journal **6** (6): 17.
[120]. Hanson K. and Worrall E. (2002). Social Marketing of Insecticide Treated Nets- Phase 2 (SMITN2),Tanzania: End of Project Household Survey Analysis. London, Malaria Consortium: 43
[121]. Harpham T (1997) Urbanisation and health in transition. Lancet 349, 11–13.
[122]. Harrison, B. A. and Scanlon, J. E. (1975). Medical entomology studies. Il. The subgenus Anopheles in Thailand (Diptera: Culicidae). Contributions of the American Entomological Institute (Ann Arbor), 12: 1 -307.
[123]. Hartman TK, Rogerson SJ, Fischer PR (2010). "The impact of maternal malaria on newborns". Annals of Tropical Paediatrics **30** (4): 271–82.
[124]. Hay S.I., Rogers D.J., Tommer J.F. and Snow R.W. (2000) Annual Plasmodium falciparum entomological inoculation rates (EIR) across Africa: literature survey, internet access and review. Transactions of the Royal Society of Tropical Medicine and Hygiene, 94, 113-127.
[125]. Hay SI, Okiro EA, Gething PW, Patil AP, Tatem AJ, Guerra CA, Snow RW (2010). Mueller,Ivo, ed. "Estimating the global clinical burden of Plasmodium falciparum malaria in 2007". PLoS Medicine **7** (6):
[126]. Himeiden, Y.E., Malik, E.M. and Adam, E. (2005). Epidemiological and seasonal pattern of malaria in irrigated areas of eastern Sudan. American Journal of Infectious Disease 1(2): 75-78.
[127]. Holding, P. & Kitsao-Wekulo, P. K. (2004), "New perspectives on the causes and potential costs of malaria: The growth and development of children".Am. J.Trop Med Hyg.
[128]. Holtz T. H., Marum L. K., Mkandala C., Chizani N., Roberts J. M., Macheso A., Parise M. E.and Kachur S. P. (2002) Insecticide-treated bed net use, aneamia, and malaria parastaemia in Blantyre District, Malawi. Tropical Medicine and International Health **7**: 220-30.
[129]. Howitt P, Darzi A, Yang GZ, Ashrafian H, Atun R, Barlow J, Blakemore A, Bull AM, Car J, Conteh L, Cooke GS, Ford N, Gregson SA, Kerr K, King D, Kulendran M, Malkin RA, Majeed A, Matlin S, Merrifield R, Penfold HA, Reid SD, Smith PC, Stevens MM, Templeton MR, Vincent C, Wilson E (2012). "Technologies for global health". The Lancet **380** (9840): 507–35.
[130]. Hussain, N.A., Echoja, A.D. & Iwarere, O. (2009), "Pattern of malaria prevention and treatment at Obisesan.Nigeria". European Journal of Scientific Research. Vol.27 No.1, pp.120-127
[131]. Ibekwe, A.C., Okonkwo, I.O., Onunkwo, A.I., Ogun, A.A. and Udeze, A.O. (2009).
[132]. Comparative prevalence level of plasmodium in freshmen (first year students) of Nnamdi Azikiwe University Awka, South-Eastern Nigeria. Malaysia Journal of Microbiology 5(1): 51-54.
[133]. Idika, N., Ezeugwu, S.M.C., Agomo, P.U., Mustapha, R.A.S., Ohuawangho, J.E., Ogbonna, F.N., Okechukwu, A.N., Enya, V.N.V., Adesanmi, A.A., Enwuru, C.A., Afocha, E.E., Agomo, C.O. and Atat, P.U. (2010). Protozoal parasitic pathogens of febrile children under five years in Ijede, Lagos state. Book of Abstract. Parasitology and Public Health Society of Nigeria. No 15.
[134]. Ijumba J. N. and Lindsay S. W. (2001) Impact of irrigation on malaria in Africa: paddies paradox. Med Vet Entomol **15**: 1-11.
[135]. Ilozumba P.C and Uzozie C.R. (2009) Prevalence of Malaria Parasitaemia and its Association with ABO Blood Group in Odoakpu Area of Onitsha South Local Government Area, Anambra State, Nigeria. Nigeria Annals of Natural Sciences Vol.8 (2): 1-8.
[136]. Imbahale SS, Fillinger U, Githekob A, Mukabanad WR, Takkena W. An exploratory surveyof malaria prevalence and people's knowledge, attitudes and practices of mosquito larval source management for malaria control in western Kenya. Acta Tropica 2010; 115(3): 248–56.
[137]. Insecticide-Treated Mosquito Nets: a WHO position statement. Geneva; World Health Organization: 2008. World Health Organization.
[138]. Institute of Medicine. (1996) Vaccines against malaria: hope in a gathering storm. Russel PK, Howson CP, eds. Washington, D.C., National Academy Press.
[139]. Iwuora, Ogochukwu Ifeoma (2012). Malaria Prevalence and Use of Insecticide Treated Nets in Urban and Rural Areas of Awka North and South Local Government Areas. Pp 54
[140]. Jamieson A, Toovey S, Maurel M (2006). Malaria: A Traveller's Guide. Struik. p. 30.
[141]. Jamu L., Hanson K. and Worrall E. (2002). Social marketing of Insecticide- Treated Nets (SMITN) PSI Tanzania [Briefing Note], PSI Tanzania Kajfasz P (2009). "Malaria prevention". International Maritime Health **60** (1–2): 67–70.
[142]. Kalu Mong Kalu, Nwogo Ajuka Obasi, Florence Onyemachi Nduka and Glory Otu Christian, 2012. A comparative study of the prevalence of malaria in Abia State, Nigeria. Research Journal of Parasitology 7: 17-24
[143]. Kaona F., Siajunza M. T., Manyando C., Khondowe S. and Ngoma G. K. (2000) Utilisation of malarial drugs at a household level: results from a KAP study in Choma, southern province and Mporokoso, northern province of Zambia. Central African Journal of Medicine **46**: 268-70.
[144]. Keating J, Macintyre K, Mbogo CM, Githure JI, Beier JC: Characterization of potential larval habitats for Anopheles mosquitoes in relation to urban land-use in Malindi, Kenya. Int J Hlth Geogr 2004, 3:9-21
[145]. Keiser J, Utzinger J, Castro MC, Smith TA, Tanner M, Singer BH: Urbanization in sub-Saharan Africa and implication for malaria control. Am J Trop Med Hyg 2004, 71:118-127.
[146]. Kimani EW, Vulule JM, Kuria IW, Mugisha F. Use of insecticide-treated clothes for personal protection against malaria: a community trial. Malar J 2006; 5-63.
[147]. Kleinman A (1980) Patients and Healers in the Context of Culture. University of California Press, Berkeley.
[148]. Klinkenberg P, McCall PJ, Hastings IM, Wilson MD, Amerasinghe FP, Donnelly MJ: Malaria and irrigated crops, Accra, Ghana. Emerg Infect Dis 2005, 11:1290-1293
[149]. Kloos H, Etea A & Degefa A (1987) Illness and health behaviour in Addis Ababa and rural Central Ethiopia. Social Science and Medicine 25, 1003–1019.
[150]. Khamlome B, Eto H, Mita T, Sakurai M, Saito T, Tsuzuki A, et al. The status of malaria before and after distribution of ITNs from 1999 to 2006 in two districts of Khammouanne province, Lao. Tropical medicine and Health, 2007; 35: p343-50.

[151]. Knell, A.J. (1991). Malaria: A Publication of the Tropical Programme of the Wellcome Trust Oxford University Press, Oxford London 84pp.
[152]. Knight, K. L. and Stone, A. (1977). A catalogue of the mosquitoes of the world(Diptera: Culicidae) (Thomas Say Foundation, Vol. Vl). College Park, Entomological Society of America, 610 pp.
[153]. Kondrashin, A.V. (1992). Malaria in the WHO Southern Asia region. Indian Journal of Malariology **29**:129-160.
[154]. Koram K. A., Bennett S., Adiamah J. H. and Greenwood B. M. (1995) Socioeconomic risk factors for malaria in a peri-urban area of the Gambia. Transactions of the Royal Society of Tropical Medicine and Hygiene **89**.
[155]. Korenromp E., Bertherat E., Dye C. and Clarke J. P. (2001). Inequity in malaria burden and control. Conference on Inequity in HIV, TB and malaria control, Bellagio, Italy.
[156]. Krogstad F.M, Cogswell F.B (1996). Aminoquinolines that circumvent resistance in Plasmodium falciparium invitro. American Journal of Tropical Medicine. 1996 Dec;55(6):579-83
[157]. Kumar, S., A. Yadavam, D.B. Keister, J.H. Tian, M. Ohl, K.A. Perdue-Greenfield, A., Miller, L.H and Kaslow, D.C. (1995). Immunogenicity and in vivo efficacy of recombinant Plasmodium falciparum merozoite surface protein-1 in Aotus monkeys. Molecular Medicine. **1:**325-332.
[158]. Lampietti J. A., Poulos C., Cropper M. L., Mitiku H. and Whittington D. (1999). Gender and Preferences for Malaria Prevention in Tigray, Ethiopia. Policy Report on Gender and Development. World Bank Working Paper Series Laxminarayan, R. (2004). Does reducing malaria improve household living? Standards? Tropical Medicine and International Health 9(2): 267-272.
[159]. Layne SP. "Principles of Infectious Disease Epidemiology" (PDF). EPI 220. UCLA Department of Epidemiology. Archived from the original on 2006-02-20. Retrieved 2007-06-15.
[160]. Lengeler C. Insecticide-Treated Bed Nets and Curtains for Preventing Malaria. Cochrane Database System. Rev.2004.
[161]. Lindsay S.W., Alonso P.L., Amstrong Shellenberg J.R.M., Hemingway J., Thomas P.J.,Shenton F.C. and Greenwood B.M. (1993) A malaria control trial using insecticide treated bed nets and targeted chemoprophylaxis in a rural area of The Gambia, West Africa. 3. Entomological characteristics of the study area. Transactions of the Royal Society of Tropical Medicine and Hygiene 87, Supplement 2: 19-23.
[162]. Lozano R et al. (2012). "Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the Global Burden of Disease Study 2010". Lancet **380** (9859): 2095–128
[163]. Macan, T. T. (1950).The anopheline mosquitoes of Iraq and North Persia. In: Leeson, H. S.,ed. Anopheles and Malaria in the Near East Memoirs of The London School of Hygiene and Tropical Medicine, London, Lewis, UK. No7 pp 109-219.
[164]. Machault V, Vignolles C, Borchi F, Vounatsou P, Pages F, Briolant S, Lacaux JP, Rogier C (2011). "The use of remotely sensed environmental data in the study of malaria" (PDF). Geospatial Health **5** (2): 151–68.
[165]. Macintyre K, Keating J, Okbaldt YB, Zerom M, Sosler S, Ghebremeskel T. Rolling out insecticide treated nets in Eritrea: Examining the determinants of possession and use in malarious zones during the rainy season. Trop Med Int Health 2006; 11:824-33
[166]. Mahon, R. J. and Miethke, P. M. (1982). Anopheles farauti No. 3, a hitherto unrecognized biological species of mosquito within the taxon Anopheles.farauti Laveran. Transactions of the Royal Society of Tropical Medicine and Hygiene, 76: 8-12.
[167]. Makler, M. T., Piper, R. C. and Milhous, W. K (1998). Lactate dehydrogenase and the diagnosis of malaria. Parasitology Today **14**: 376-377.
[168]. Makler, M.T., Palmer, C.J. and Ager A.L. (1998). A review of practical techniques for the diagnosis. Annals Tropical Medicine Parasitology **192:**419-433.
[169]. "Malaria Fact sheet N°94". WHO. March 2014. Retrieved 28 August 2014.
[170]. Malaria Foundation International (2008) http://www.malaria.org/index. php?option=com
[171]. _content&task=view&id=132&Itemid=32. UNITAID Executive Board. Geneva.
[172]. Martens P. and Hall L. (2000) Malaria on the move: Human population movement and malaria transmission. Emerging Infectious Diseases **6**.
[173]. Martens, W.J.M., Niessen, L.W., Rotmans, J. Jetten, T.H., and M.C. Michael, A.J.(1995).
[174]. Potential Impact of Global climate change on Malaria risk Environmental Health Perspectives **103(5):** 458-464.
[175]. Mbanugo, J . I and Ejims, D. O. (2000). Plasmodium infections in children aged 0-5 years in Awka Metropolis, Anambra State, Nigeria. Nigerian Journal of Parasitology, 21: 55-59.
[176]. Mbanugo, J. I. and Emenalo, S. E. (2004).Prevalence of malaria parasitaemia among blood donors in Owerri, Imo State, Nigeria. Nigeria Journal of Parasitology, 25: 75 -80.
[177]. Mburu FM, Spencer HC & Kasesje DCO (1987) Changes in sources of treatment occurring after inception of a community-based malaria control programme in Saradidi, Kenya. Annals of Tropical Medicine and Parasitology 81 (Suppl. 1), S105–S110.
[178]. Miller JM, Korenromp EL, Nahlen BL, Steketee R. Estimating the number of insecticide treated nets required by African households to reach continent widemalaria coverage targets. JAMA 2007; 297: p2241-50.
[179]. Molineux, L. and Gramiccia, G. (1980). The Garki Project Research on the Epidemiological and control of malaria in the Sudan savanna of West Africa.World Health Organization. 311 p.
[180]. Molineaux, L. (1988). The Epidemiology of Human malaria as an explanation of its distribution including of its distribution including some implications for its control, Malaria, principle and practice of malariology, volume, 1 Wernsdorfer, W.H and McGregor, I.A. (eds) Churchill- Livingstone, Edinburgh, London , Melbourne New York 998pp.
[181]. Molyneux C.S, Mung'ala-Odera. V, Harpham. T and Snow R.W. Maternal responses to childhood fevers: a comparison of rural and urban residents in coastal Kenya. Tropical Medicine and International Health. volume 4 no 12 pp 836–845 december 1999
[182]. Morgan, U.M. and Thompson (1998). Molecular detection of parasitic protozoa. Parasitology **117**: 573-585.
[183]. Mugisha F, Arinative J. Sleeping arrangements and mosquito net use among under- fives: results from the Uganda demographic and health survey. Malaria Journal 2003;2:40
[184]. Murray CJ, Rosenfeld LC, Lim SS, Andrews KG, Foreman KJ, Haring D, Fullman N, Naghavi M, Lozano R, Lopez AD (2012). "Global malaria mortality between 1980 and 2010: A systematic analysis". Lancet **379** (9814): 413–31.
[185]. Mutero C. M., Blank H., Konradsen F. and van der Hoek W. (2000) Water management for controlling the breeding of Anopheles mosquitoes in rice irrigation schemes in Kenya. Acta Tropica **76**.
[186]. Nadjm B, Behrens RH (2012). "Malaria: An update for physicians". Infectious Disease Clinics of North America **26** (2): 243–59.
[187]. Narain, J.P. (2008), "Malaria in the South-East Region: Myth and the Reality". Indain J.Med. Research. 128. July. pp. 1-3
[188]. National Malaria Control Programme (NMCP),(2007) Federal Ministry of Health. Annual Report. Abuja. Nigeria.
[189]. Nchinda, T. (1998). Malaria: A Reemerging Disease in Africa. WHO: Emerging Infectious Diseases,Volume 4 No. 3.
[190]. Ndawala J., Kalanda G. and Mahy M. (2000). Malawi MDHS Data Analysis, Malawi National Statistics Office.http://www.nso.malawi.net

[191]. Nduka, F.O., Egbu, A., Okafor, C. and Nwaugo, V.O. (2006). Prevalence of malaria parasites and anaemia in pregnant and non pregnant women in Aba and Okigwe towns of Southeast Nigeria. Animal Research International 3(30: 508-512.
[192]. Nebe, O. J., Adeoye, G. O. and Agomo, P. U. (2002). Prevalence and clinical profile of malaria among the coastal dwellers of Lagos State, Nigeria. Nigerian Journal of Parasitology, 23:61 - 68.
[193]. Nevill CG. (1990) Malaria in sub-Saharan Africa. Social Science & Medicine, 31(6):667-669.
[194]. Nevill CG, Some ES, Mung'ala VO, Mutemi W, New L, Marsh K, et al. Insecticide treated bednets reduce mortality and severe morbidity from malaria among children on the Kenyan coast. Trop Med Int Health 1996; 1:139-46
[195]. Nigeria Demographic and Health Survey (NDHS) (2003). Pp. 106
[196]. Nigeria Demographic and Health Survey 2008. Abuja; National Population Commission 2009.
[197]. National Population Commission and ICF Macro.
[198]. Njau, J., Goodman, C., Kachur, S., Palmer, N. Khatib, R.A., Abdulla, S., Mills, A. and Bioland, P. (2006). Fever treatment and household wealth: the challenges posed for rolling out combination therapy for malaria. Tropical Medicine and International Health 11: 299-313.
[199]. Nmadu P.M, Peter E, Alexander P., Koggie A.Z., Maikenti J.I. The Prevalence of Malaria in Children between the Ages 2-15 visiting Gwarimpa General Hospital Life-Camp, Abuja. Nigeria, Journal of Health Science, Vol.5 No.3, 2015 pp. 47-51
[200]. Noor AM, Amin AA, Akhwale WS, Snow RW. Increasing coverage and decreasing inequity in insecticide-treated bed net use among rural Kenyan Children. PLoS Med2007;4: e255.
[201]. Noor AM, Omumbo JA, Amin AA, Zurovac D, Snow RW. Wealth, mother's education andphysical access as determinants of retail sector net use in rural Kenya. Malaria Journal 2006; 5:5.
[202]. Noutcha, M.A.E. and Anumudu, C.I. (2009). Entomological indices of Anopheles gambiae Sensu lato at a rural community in south-west Nigeria. J Vector Borne Dis; 46: 43–51.
[203]. Nurain, S. (2004). Characterization and control of the dry season Plasmodium falciparum gametocyte reservoir in an area of marked seasonal transmission in Sudan. Malaria Drug Studies (http://www.emro.who.int/tdr/PDF/proj01-58.pdf) pp30-31.
[204]. Nuwaha F. (2001) Factors influencing the use of bed nets in Mbarara municipality of Uganda. American Journal of Tropical Medicine and Hygiene **65**: 877-82.
[205]. Nwosu, E.C., Nduka, F.O., Etusim, P. and Ndubuka, G.I.N. (2010). Malaria infection among pregnant women in south-eastern Nigeria using peripheral blood smear, placental blood and placental histology. Book of Abstract. Parasitology and Public Health Society of Nigeria. No 60.
[206]. Obiezue, R.N.N., Okoye, I.C. and Amoke, O.C. (2010). The relationship between fever and malaria parasitaemia among school children in Aguluzigbo, Anaocha Local Government Area of Anambra state. Book of Abstract. Parasitology and Public Health Society of Nigeria. No 39.
[207]. Oche, M.O., Ameh, I.G., Umar, A.S., Gana, G. and Njoku, C.H. (2010). Insecticide Treated Nets awareness among pregnant women. Nigerian Journal of parasitology 31(2): 98-101.
[208]. Ojiezeh, T. I., Ibeh, N. I., Opedun, D.O. and Udoh, S.J. (2010). Malaria endemicity among pregnant women in urban and semi-urban areas of southwest, Nigeria. American-Eurasia Journal of Scientific Research 5(3): 207-211
[209]. Okeke, T.A., Uzochukwu, B.S. and Okafor, H.U. (2006). An in depth study of patent medicine sellers perspective on malaria in rural Nigerian community.Malaria Journal 5: article 97.
[210]. Okocha, E.C., Ibeh, C.C., Ele P.U. and Ibeh, N.C. (2005). The prevalence of malaria parasitaemia in blood donors in an Nigerian teaching hospital. Journal of Vector Borne Diseases 42: 21-24.
[211]. Okogun, G.R.A., Anosike, J.C., Okere, A.N. and Nwoke B.E.B. (2005). Ecology of Mosquitoes of Midwestern Nigeria. Journal of Vector Borne Disease 42:1-8.
[212]. Okoli, C.G. (2010). Malaria in Uyo, Akwa Ibom state, Nigeria. Book of Abstract. Parasitology and Public Health Society of Nigeria. No 53.
[213]. Okrah J., Traore C., Pale A., Sommerfeld J. and Muller O. (2002) Community factors associated with malaria prevention by mosquito nets: an exploratory study in rural Burkina Faso. Tropical Medicine and International Health **7**: 240-8.
[214]. Olasehinde G.I, Ojurongbe D.O, Akinjogunla O.J, Egwari L.O and Adeyeba A.O, 2015.
[215]. Prevalence of malaria and Predisposing Factors to Antimalaria Drug Resistance in South western Nigeria. Research Journal of Parasitology, 10:92-101
[216]. Olowu J. A., Sowunmi A. and Abohweyere A. E. (2000) Congenital malaria in a hyperendemic area: a revisit. African J Med Med Science **29**: 211-3.
[217]. Olumese P. E., Sodeinde O., Ademowo O. G. and Walker O. (1997) Protein energy malnutrition and cerebral malaria in Nigerian children. J Trop Pediatr **43**: 217-9.
[218]. Olupot-Olupot P, Maitland, K (2013). "Management of severe malaria: Results from recent trials". Advances in Experimental Medicine and Biology. Advances in Experimental Medicine and Biology **764**: 241–50.
[219]. Onwujekwe, O., Henson, K. & Fox Rushby, J. (2004), "Inequalities in Purchases of Mosquito Nets and willingness to pay for insecticides treated Net in Nigeria" Malaria Journal 3(6):1-8
[220]. Onwujekwe, O., Uzochukwu B., Dike, N., Okoli, C., Eze, S. and Chukwuogo O. (2009).
[221]. Are there geographical and socioeconomic differences in incidence, burden and prevention of malaria? A study in Southeast Nigeria. International Journal for Equity in Health 8:45.
[222]. Onyido, A.E., Ezike, V.I., Ozumba, N.A., Nwankwo, A.C.N., Nwankwo, E.A., (2009).
[223]. Yellow fever vectors' surveillance in three satellite communities of Enugu Municipality. The Nigerian Journal of Parasitology 30(1): 13-17.
[224]. Oparaocha, E.T, 2003. The impact of haemoglobin level and concomitant infections on malaria parasitaemia and onset of fever during malaria attack in Ikwuano local government area of Abia State, Nigeria. The Nigerian Journal of Parasitology. 24:25-32
[225]. Orimadegun, A.E., Fawole, O., Okereke, J.O., Akinbami, F.O. and Sodeinde, O. (2007).
[226]. Increasing burden of childhood severe malaria in a Nigerian tertiaryhospital: implications for control. Journal of Tropical Pediatric 53: 185-189
[227]. Owusu-Ofori AK, Parry C, Bates I (2010). "Transfusion-transmitted malaria in countries where malaria is endemic: A review of the literature from sub-Saharan Africa". Clinical Infectious Diseases **51** (10): 1192–8.
[228]. Oyewole, I.O., Awolola, T.S., Ibidapo, C.A., Oduola, A.O., Okwa, O.O. and Obansa J.A. (2007).
[229]. Behavior and Population Dynamics of the Major Anopheline Vectors in a Malaria Endemic Area in Southern Nigeria. Journal of Vector Borne Diseases. 44: 56-64.

[230]. Panvisavas S. (2001) Poverty and Malaria: a study in a Thai-Myanmar border area. Southeast Asian Journal of Tropical Medicine and Public Health Parham PE, Christiansen-Jucht C, Pople D, Michael E (2011). "Understanding and modeling the impact of climate change on infectious diseases". In Blanco J, Kheradmand H (eds.). Climate Change – Socioeconomic Effects. pp. 43–66.
[231]. Phillip, R.S (2001). Current status of malaria and potential for control. Clinical Microbiology Reviews **4(1)**: 208-226.
[232]. Postiglione, M., Tabanli, B. and Ramsdale, C. D. (1973). The Anopheles of Turkey. Rivista de Parassitologia, 34: 127-159.
[233]. Provost C (April 25, 2011). "World Malaria Day: Which countries are the hardest hit? Get the full data". The Guardian. Retrieved 2012-05-03.
[234]. Rajasekhar M. and Nandakumar N. V. (2000) Occupational malaria and health risk among select occupational health care employee groups in an urban hospital at Tirupati, A. P. Indian Journal of Malariology **37**: 53- 60.
[235]. Rao, T. R . (1984). The anophelines of India. New Delhi, Malaria Research Centre, 518 pp.
[236]. Rashed S., Johnson H., Dongier P., Moreau R., Lee C., Crepeau R., Lambert J., Jefremovas V. and Schaffer C. (1999) Determinants of the Permethrin Impregnated Bednets (PIB) in the Republic of Benin: the role of women in the acquisition and utilization of PIBs. Soc Sci Med **49**: 993-1005.
[237]. Rashed S., Johnson H., Dongier P., Moreau R., Lee C., Lambert J. and Schaefer C. (2000).
[238]. Economic impact of febrile morbidity and use of permetherin-impregnated bed-nets in a malarious area I. Study of demographics, morbidity, and household expenditures associated with febrile morbidity in the Republic of Benin. American Journal of Tropical Medicine and Hygiene **62**: 173-180. **32**: 608-14.
[239]. Reid, J. A. (1968). Anopheline mosquitoes of Malaya and Bomeo. Studies from the Institute for Medical Research, Malaysia. No. 31. Kuala Lumpur, Government of Malaysia, 520 pp.
[240]. Reid, J. A., Harrison, B. A. and Atmosoedjono, S. (1979).Variation and vector status in Anopheles barbirostris. Mosquito Systematics, 11: 235-251.
[241]. Roca-Felter, A., Carneiro, I., Armstrong, I.E. and Schellenberg, J.R.(2008). Estimates of the burden of malaria morbidity in Africa in children under the age of five. Tropical Medicine and International Health 13(6): 771-783.
[242]. Robert V, Macintyre K, Keating J, Trape JF, Duchemin JB, Warren M, Beier JC: Malaria transmission in urban sub-Saharan Africa. Am J Trop Med Hyg2003, 68:169-176.
[243]. Roll Back Malaria (RBM, 2000). Publication of the Roll Back Malaria, Partnership Secretariat. Abuja Declaration and Plan of Action. 12 pages.
[244]. Roll Back Malaria, (2005) Economic Cost of Malaria. WHO.
[245]. Roll Back Malaria (RBM, 2005). Facts about malaria in Nigeria, Publication of the Roll Back Malaria pp. 1-2
[246]. Rozendaal, J. (1997). Vector Control Methods for use by individuals and communities, WHO, Geneva 412pp.
[247]. Rugemalila JB, Wanga CL, Kilama WL. Sixth Africa malaria day in 2006: how far have we come after the Abuja Declaration? Malar J 2006; 5:102.
[248]. Runsewe-Abiodun, I.T., Ogunfowora. O.B. and Fetuga, B.M. (2006). Neonatal malaria in Nigeria--a 2 year review. BMC Pediatr. 12: 6-19.
[249]. Sachs, J. & Malaney, P. (2002), "The Economic and Social Burden of Malaria". Macmillan Pub.Ltd. Nature 415(6872): 680-685.
[250]. Salako, L.A. (2002). National malaria day awareness walk. Text of an address given on the occasion of the malaria awareness walk held in Abuja. Journal of Tropical Africa 1:6-7.
[251]. Sara, E.J. (1990). The bionomic of mosquitoes in selected sites in Maiduguri unpublished M.Sc. Dissertation University of Maiduguri, Nigeria.118pp.
[252]. Sarkar PK, Ahluwalia G, Vijayan VK, Talwar A (2009). "Critical care aspects of malaria". Journal of Intensive Care Medicine **25** (2): 93–103.
[253]. Schiff, L.J., Minjas, J. and Premji**.** Z. (1993). The rapid manual Parasight F test. A new diagnostic tool for Plasmodium falciparum infection. Transactions of the Royal Soceity of Tropical Medicne and Hygiene **87:**646-648.
[254]. Service M. W. (1991) Agricultural development and arthropod-borne diseases: A review. Rev Saude Publica **25**: 165-8.
[255]. Service, M.W. (1993): Mosquito Ecology. Field Sampling Methods 2nd Ed. London, Elsevier Applied Scences 23pp.
[256]. Shell E. R. (1997) Resurgence of a deadly disease. The Atlantic Monthly.
[257]. Shulman C. E., Marshall T., Dorman E. K., Bulmer J. N., Cutts F., Peshu N. and Marsh K.
[258]. (2001) Malaria in pregnancy: adverse effects on haemoglobin levels and birthweight in primigravidae and multigravidae. Tropical Medicine and International Health **6**: 770-8.
[259]. Smith T., Genton B., Betuela I., Rare L. and Alpers M. P. (2002) Mosquito nets for the elderly? Transactions of the Royal Society of Tropical Medicine and Hygiene **96**: 37-8.
[260]. Snow R.W., Craig M., Deichmann U. and Marsh K. (1999) Estimating mortality, morbidity and disability due to malaria among Africa's no-pregnant population. Bulletin of the World Health Organization 77: 624-640.
[261]. Stock R (1985) Health care for some: a Nigerian study of who gets what, where and why? International Journal of Health Services 15, 469–483.
[262]. Stoler J, Weeks JR, Getis A, and Hill AG. Distance threshold for the effect of urban agriculture on elevated self-reported nalaria prevalence in Accra, Ghana. Am J Trop Med Hyg 2009; 80(4), 2009: 547–54.
[263]. Strickland GT. (1992) Fever in the returned traveler. Medical Clinics of North America, November, 76(6): 1375-1392.
[264]. Sychareun V., Phengsavanh A., Kitysivoilaphanh B., Prabouasone K., Viriyavejakul P., Krudsood S., Phophak N. and Looareesuwan S. (2000) A study of anaemia in pregnant women with Plasmodium falciparum at district hospitals in Vientiane, Lao PDR. Southeast Asian J Trop Med Public Health 31Supplement.1: 91-8.
[265]. Tanner M & Harpham T (1995) Action and research in urban health development – progress and prospects. In Urban Health in Developing Countries: Progress and Prospects (eds T Harpham & M Tanner). Earthscan Publications Ltd, London, pp. 216–220.
[266]. Tanner M. and Vlassoff C. (1998) Treatment-seeking behaviour for malaria: a typology based on endemicity and gender. Social Science and Medicine **46**: 523-532.
[267]. Taylor WR, Hanson J, Turner GD, White NJ, Dondorp AM (2012). "Respiratory manifestations of malaria". Chest **142** (2): 492–505.
[268]. The African Malaria Report (2003). Insecticide treated net. Bulletin of the W.H.O. 83(2): 24-30
[269]. "The World Gazetteer". Archived from the original on 2013-02-09. Retrieved 2007-04-06
[270]. Thrusfield, M., 2005. Surveys In: Veterinary Epidemiology,. Blackwell Science Ltd, London.
[271]. Tin-Oo, Pe-Thet-Htoon, Khin-Thet-Wai, Parks W. and Bryan J. (2001) Gender, mosquitoes and malaria: implications for community development programs in Laputta, Myanmar. Southeast Asian Journal of Tropical Medicine and Public Health **32**: 588-94.

[272]. Tran TM, Samal B, Kirkness E, Crompton PD (2012). Systems immunology of human malaria" "Trends in Parasitology **28** (6): 248–57.
[273]. Trape J.F. (2001) The public health impact of chloroquine resistance in Africa. American Journal of Tropical Medicine and Hygiene 64 (supplement) 12-17.
[274]. Trape J.F., Rogier C., Konate L., Diagne N., Bouganali H., Canque B., Legros F., Badji A.,Ndiaye G., Ndiaye P., Brahimi K., Faye O., Druilhe P. and DA Silva L.P. (1994) The Dielmo Project : a longitudinal study of natural malaria infection and the mechanisms of protective immunity in a community living in a holoendemic area of Senegal. American Journal of Tropical Medicine and Hygiene 51 (2): 123-137.
[275]. Ukaga, C.N., Nwoke, B.E.B., Udujih, O.S., Udujih, O.G., Ohaeri, A.A., Anosike, J.C., Udujih, B.U. and Nwachukwu, M.I. (2007). Placental malaria in Owerri, Imo state, Southeastern Nigeria. Tanzania Health Research Bulletin 9(3): 180-185
[276]. Uko, E.K., Emeribe, A.O. and Ejezie, G.C. (1998). Malaria infection of the placenta and neonatal low birth weight in Calabar. Journal of Medical Laboratory Science 7:7-10.
[277]. Ukpai,O.M and E.I Ajoku, 2001. The Prevalence of malaria in Okigwe and Owerri areas of Imo State. Nigeria Journal of Parasitology. 22: 43-48.
[278]. Umar, R.A. and Hassan, S.W. (2001). The relationship between levels of parasitaemia and anaemia in children with malaria. Sahel Medical Journal 5(1): 58-62.
[279]. Umeanaeto, P.U. and Ekejindu, M. (2006). Prevalence and intensity of malaria in blood donors at Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, Anambra state Nigeria. Nigeria Journal of Parasitology 27: 11-15.
[280]. United Nations: World Urbanization Prospects: The 2001 Revisions. Population Division Department of Economics and Social Affair of the United Nations. New York; 2002.
[281]. United Nation, (2005) Coming to Grips with Malaria in the new millennium.United Nations. New York.
[282]. Usip, L.P.E. and Udofia, B. (2010). Concomitant bacteria in the blood of malaria patients among the students of University of Uyo, Uyo, Akwa Ibom state, Nigeria. Book of Abstract. Parasitology and Public Health Society of Nigeria. No 45.
[283]. Utzinger J, Keiser J: Urbanization and tropical health - then and now. Ann Trop Med Parasitol 2006, 100:517-533.
[284]. Uwaha F. Factors influencing the use of bed nets in Mbarara municipality of Uganda. Am J Trop Med Hyg 2001; 65:877-82.
[285]. Uzochukwu, B.S.C. and Onwujekwu, O.(2004). Socio-economic differences and health seeking behavior for the diagnosis and treatment of malaria; a case study of four L.G.A. operating the Bamako initiative programme in southeast Nigeria. International Journal for Equity in Health 4: 12-18.
[286]. Vlalual D, Galea S: Urban health: a new disciple. Lancet 2003, 362:1091-2.
[287]. Wardlaw T. (2003). UNICEF MICS malaria data. Meeting of the RBM Monitoring and Evaluation Reference Group, Washington DC.
[288]. White, G. B. (1978). Systematic reappraisal of the Anopheles maculipennis complex. Mosquito Systematics, 10: 13-44.
[289]. White, G. B. (1983). The importance of Anopheles leucosphyrus group mosquitoes as vectors of malaria and filariasis in relation to transmigration and forestry in Indonesia, with assessment of Anopheles balabacensis ecology and vectorial capacity. Unpublished report to WHO-VBCRU, Jakarta, 55 pp.
[290]. White, G. B. (1985).Anopheles bwambae sp.n., a malaria vector in the Semliki Valley, Uganda, and its relationships with other sibling species of the Anopheles gambiae complex (Diptera: Culicidae). Systematic Entomology,10: 501-522.
[291]. White NJ (2011). "Determinants of relapse periodicity in Plasmodium vivax malaria". Malaria Journal **10**: 297.
[292]. WHO (1997) World malaria situation in 1994. Weekly epidemiological Record 72, 269-276
[293]. WHO, (2003) The Africa Malaria Report.WHO/CDS/MAL/2003. 1093.2003 WHO. Geneva.
[294]. WHO / UNICEF; The Africa Malaria Report for year 2003, 2003; p9-29.
[295]. WHO, (2008) World Malaria Report. WHO. Geneva.
[296]. WHO (2014). World Malaria Report 2014. Geneva, Switzerland: World Health Organization. pp. 32–42.
[297]. World Bank (1993) World Development Report 1993 – Investing in health. Oxford University Press, Oxford.
[298]. World Health Organization (1982). Manual on environmental management for mosquito control with special emphasis on malaria vectors. WHO offset publication no **66,** World Health Organization Geneva 283pp.
[299]. World Health Organization (WHO). (1989). Geographical distribution of arthropod-borne diseases and their principal vectors. WHO/VBC/89.967.Geneva.
[300]. World Health Organization (1992a). Entomological field techniques for malaria control part I learners guide. World Health Organisation, Geneva.
[301]. World Health Organization (1992b). Vector resistance to pesticides. Fifteenth Report of the WHO Expert Committee on Vector Biology and control, Technical report **818** World Health Organization Geneva.
[302]. World Health Organization (1996). Investing in health research and development. Document TDR/Gen/96.1. Ad Hoc Committee of Health Research Relating to Future Intervention Options, World Health Organization, Geneva, Switzerland.
[303]. World Health Organization. (1997) Control of tropical diseases: malaria prevention and control.
[304]. Geneva, World Health Organization.
[305]. World Health Organization, WHO (1998) Fact Sheet No. 203, (Roll Back Malaria), Geneva, Switzerland.
[306]. World Health Organization (2000). Management of severe Malaria: A practical handbook 47-48.
[307]. World Health Report (2002) Reducing Risk, Promoting Healthy Life. Geneva: World Health Organisation (WHO)
[308]. World Health Organization (2006). Malaria vector control and personal protection. Technical report series No. **936** World Health Organization Geneva.
[309]. World Health organization (WHO 2005). World Malaria Report Geneva, Switzerland.
[310]. World Health Organization (2010). Guidelines for the treatment of malaria (2nd edition).
[311]. Geneva: World Health Organization. p. ix.
[312]. World Malaria Report 2012 (PDF) (Report). World Health Organization.
[313]. World Population Prospects. The 2006 Revision and World Urbanization Prospects.
[314]. Worrall E., Basu S., and Hanson K. The relationship between socio-economic status and malaria: a review of the literature. SES and Malaria, January 2003; 3-6.
[315]. Worrall E, Basu S, Hanson K (2005). "Is malaria a disease of poverty? A review of the literature". Tropical Health and Medicine 10 (10): 1047–59.
[316]. www.msmosquito.com
[317]. Yapabandara A. M., Curtis C. F., Wickramasinghe M. B. and Fernando W. P. (2001) Control of malaria vectors with insect growth regulator pyriproxyfen in a gem-mining area in Sri-Lanka. Acta Tropica **80**: 265- 76.

[318]. Yapabandara A. M. and Curtis C. F. (2002) Laboratory and field comparisons of pyriproxyfen polystyrene beads and other larvicidal methods against malaria vectors in Sri Lanka. Acta Tropica **81**: 211-233.
[319]. Yohannes K, Dulhunty JM, Kourleoutov C, Manuopangai VT, Polyn MK, Parks WJ, et al.
[320]. Malaria control in Central Malaita, Solomon Island. The use of insecticide impregnated nets, Acta Trop 2000; 75: 173-83
[321]. Yusuf, O.B., Adeoye, B.W., Oladepo, O.O., Peters, D.H. and Bishai, D. (2010). Poverty and fever vulnerability in Nigeria: a multilevel analysis. Malaria Journal 9:235
[322]. Zahar, A. R. (1974). Review of the ecology of malaria vectors in the WHO Eastern Mediterranean Region. Bulletin of the World Health Organization, 50: 427- 440.

Joseph Otafu Adaji, et. al. "Epidemiology of Malaria in an Urban and A Rural Area Of Benue State Of Nigeria ." *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)*, 17(2), (2022): pp. 01-22.